# MINING WORLD

November 1960


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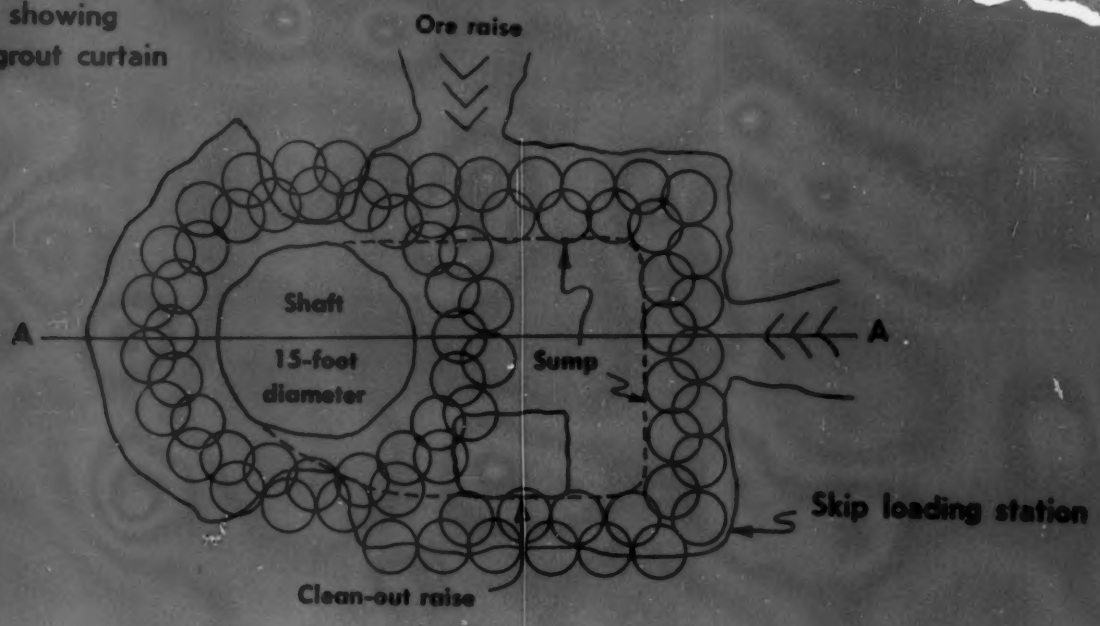


## How St. Joe Lead Grouts Shafts


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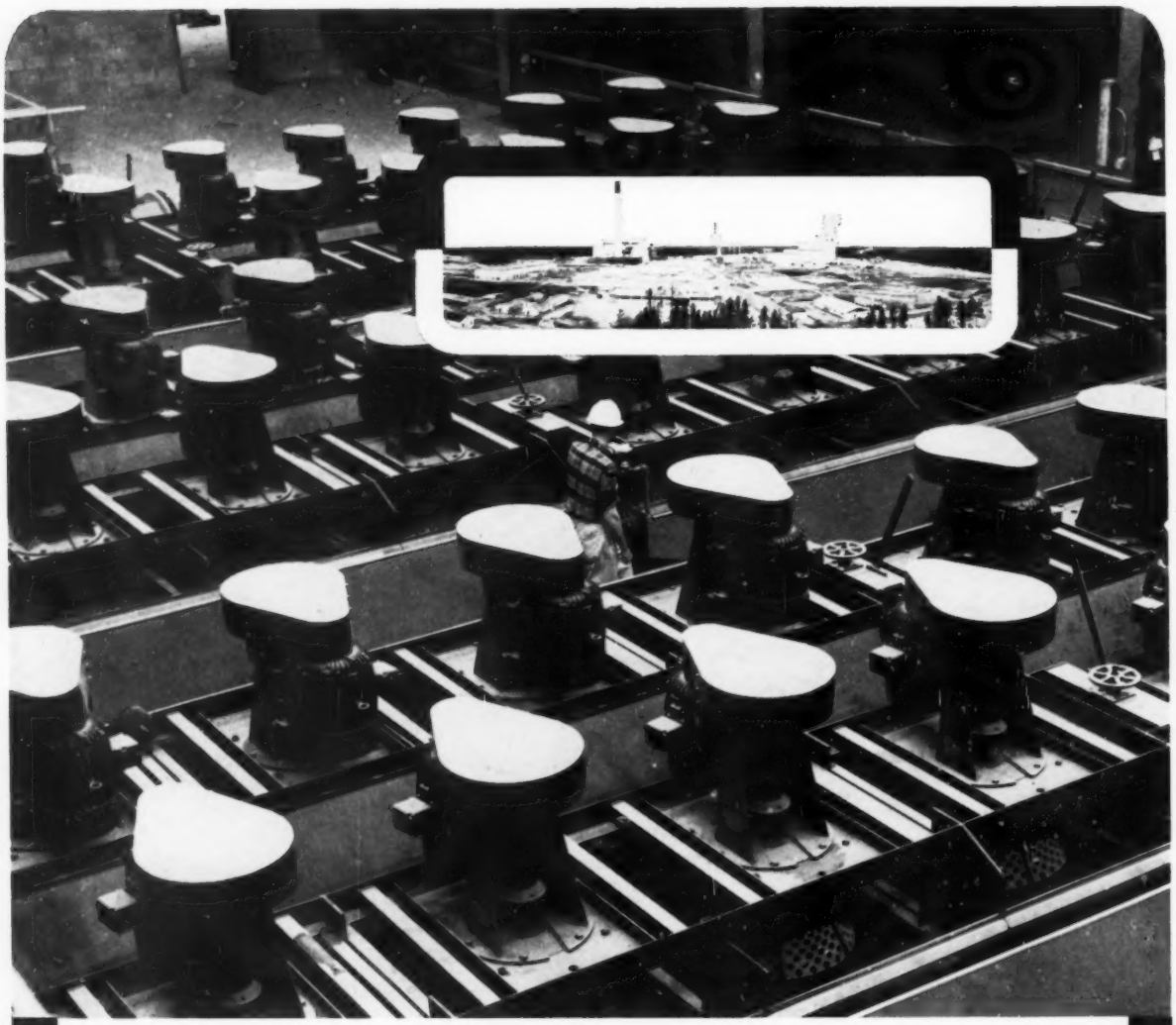

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International Nickel Company, whose giant new nickel-producing facilities at Thompson, Manitoba will make the world 75-million pounds-per-year richer when in full operation, has installed a formidable force of 139-66" Wemco-Fagergren Flotation cells for maximum recovery of mineral values.

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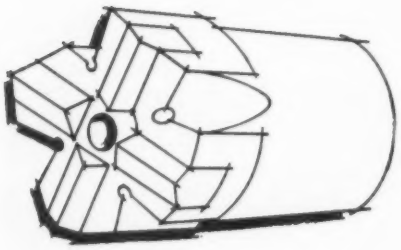
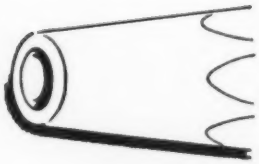
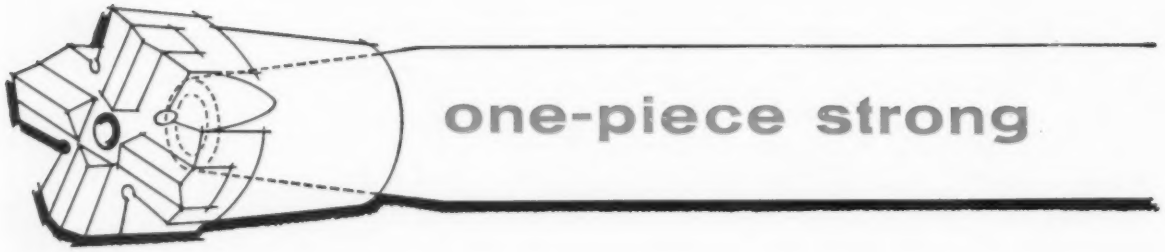


Removable



**yet**

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**removable rock bits**

MINING WORLD

. . . . . including the Export Edition, WORLD MINING

VOL. 22 No. 12 November 1960

**New Blair mucker** developed by Anglo American Corporation's chief mechanical engineer could have mucking capacity from 50 to 60 tons per hour in stopes as steep as 45° and only 30 inches high. Unit might be adapted to load shuttle cars or slusher trains ..... 29

**Magnesite production** has increased at Gabbs, Nevada as Basic Inc. has built a new flotation mill and installed a new rotary kiln. Low grade magnesite with high line and silica is concentrated by flotation ..... 30

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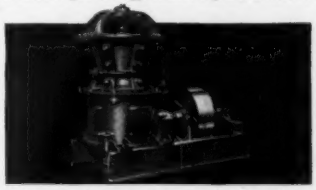
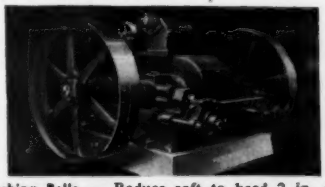
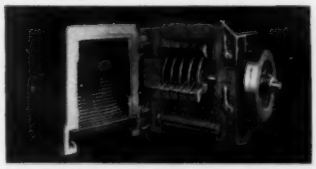


**Rotary Fine Crusher** — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



**Crushing Rolls** — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



**Hammer Mills** — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

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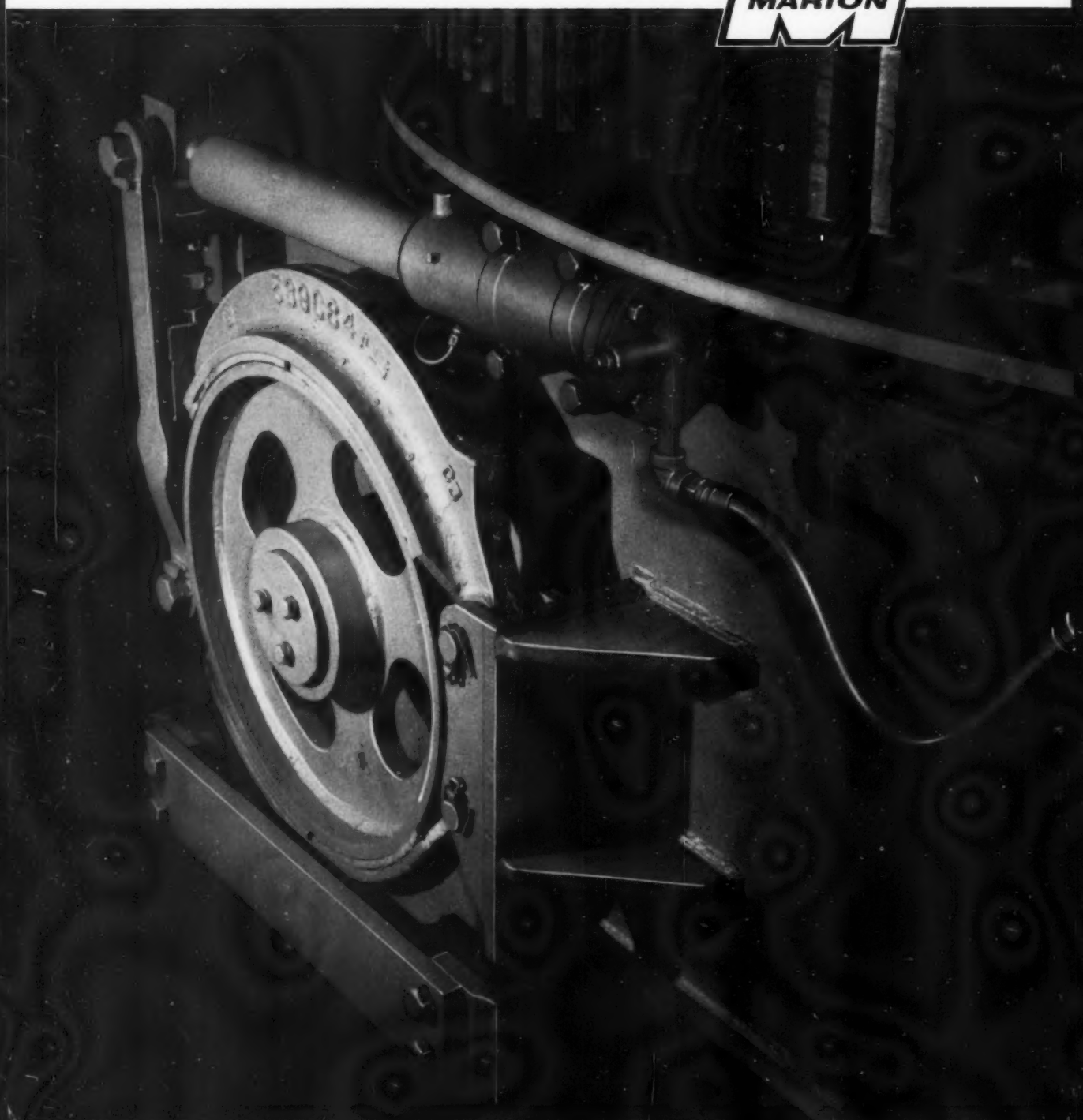
MARION



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# Silver Raid Ahead

Official silver figures recently released by the United States Treasury show these important warnings to both the financial and mining worlds:

Newly mined silver sales to Treasury have slowed.
Heavy demand for coinage silver continues.
Treasury to industry sales doubled in last year.
General fund silver will last less than three years.

The Treasury will start selling its monetary silver reserve.

For the government fiscal year ended June 30th the Treasury only had the opportunity to purchase 711,007 ounces of newly mined domestic silver, as the mining industry sold its output elsewhere.

Despite the impression that so many of us—who are not Nevada residents—get that we are living in a paper money world the Treasury uses more silver for coinage each year. Coinage was up from 36,499,628 ounces to 40,974,071 for the last fiscal year. This is what is called subsidiary coinage—dimes, quarters, half dollars—as no silver dollars have been minted since the early 1920's. More people put more coins in parking meters and vending machines of all kinds from telephones to washing machines. Nickels, not made of silver, won't buy or park anything most places today. So silver coins are more a way of life.

Industry sales have grown fastest of all in the last year; 28,170,858 ounces from 11,249,253 ounces in the year before.

All these add up to the fact that the balance in the general fund dropped to only 157,031,009 ounces. With the last yearly decrease of 65,182,246 ounces there is less than a three year's supply at this draw-down rate. The Treasury makes industrial sales under authority to sell to users at not less than 90.5 cents a troy ounce under the Act of July 31, 1946. Actually, sales are made F. O. B. San Francisco, California mint at 91.0 cents as opposed to the statutory (lawful) price of $1.29 per ounce. This is seigniorage silver.

These Treasury sales are subsidizing industrial users and holding the ceiling on world price artificially low.

Now what happens when the general fund silver runs out?

The Treasury believes there's no problem or worry. All it has to do is start selling its monetary reserve silver. This is silver held to secure outstanding silver certificates. This reserve on June 30th was 1,677,000,000 ounces.

By substituting Federal Reserve notes for silver certificates monetary silver could be released. Congressional authority would be required to make this switch in $1.00 certificates, but not for the $5.00 denomination. Many financiers think the switch will therefore be made in the $5.00 certificates.

This would be directly opposed to the directive in the Monetary Act of 1934 wherein Congress directed that monetary reserves be increased to one quarter of all reserves.

Thus the silver reserve would be whittled away. A permanent loss of a most strategic reserve. The new President and the new Congress can prevent this.

The financial and mining worlds must see that they do.

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# CAPITOL concentrates

GOVERNMENT ACTION AND REACTION AFFECTING MINING

## Revenue Service Accepts Ready For Use Depletion . . .

The Internal Revenue Service has agreed to use the Supreme Court's definition in deciding pending disputes over minerals depletion allowances. In the famous Cannelton sewer-pipe case, decided last summer, the Supreme Court ruled that the depletion allowance is to be applied to the value of minerals "ready for industrial use"—not to the more valuable manufactured product nor the less valuable ore as it comes from the mine. Previous rulings, contrary to this decision, are to be revoked. As a result a number of tax adjustments will become necessary, including additional levies in some instances and refunds in a few cases.

A number of integrated companies with operations extending from the mine to the manufacture of finished products had attempted to apply the depletion allowance to the end product. The Revenue Service maintained that the allowance applied only to the value of the minerals as they came from the ground. The issue was taken to the Supreme Court which ruled that the allowance should apply to a mineral "ready for industrial use or consumption" before final manufacture but after mine excavation. ■

## Lead-Zinc Analysis Is Requested From Secretary Seaton . . .

An analysis of the reasons why the expected improvement in the domestic lead-zinc situation has not occurred has been requested of the Interior Department by Representative Wayne Aspinall of Colorado, chairman of the House Interior Committee. In making the request of Interior Secretary Fred A. Seaton, Aspinall called his attention to the department's testimony earlier this year that quotas are bringing about an improvement which in time would establish a set of conditions leading to an efficient, economic and commercial lead and zinc mining industry.

"The most recent information that I have," Aspinall wrote, "does not indicate that any substantial recovery in domestic lead and zinc mine production has yet taken place. It would be valuable to have an analysis of the reason for the failure of the improvement to materialize, and an indication of the outlook for improvement as it now appears." ■

## Minerals Industries Have Better Safety Record . . .

A new safety record was set in 1959 by the nation's 1,100,000 employes of the mineral industries, according to an analysis of the U. S. Bureau of Mines. Fatal injuries (including some cases of total disability) declined 10 percent, and total injuries (including fatal and nonfatal) declined 4.7 percent from the 1958 rate.

Major factor in the new safety record, stated Marling J. Ankeny, Bureau director, was the continued safety gain in the mineral industries employing the largest numbers. These included petroleum and natural gas, with nearly 600,000 employes; coal, with over 200,000; stone quarrying; metal mining; and metallurgical plants. Among the major mineral industries, cement and coke had the lowest accident frequencies, 4.67 and 4.87, respectively, per 1,000,000 manhours. ■

## International Group Forecasts Lead-Zinc Surplus . . .

The United Nations Lead and Zinc Study Group, meeting in Geneva, Switzerland, estimated that the lead surplus would be around 21,000 metric tons this year and 26,000 tons in 1961. The zinc surplus for the current year was estimated at 74,000 metric tons and at 102,000 tons next year. Despite these findings of surpluses, the group urged governments not to impose new or additional barriers to international trade in the two metals.

The voluntary restriction of commercial offerings of lead by some of the exporting countries are to continue to March 31, 1961. However, no action was taken on restricting mine production. No restrictions were agreed to on zinc offerings as the countries outside the United States felt that stocks were about normal. Concern was expressed over the rapid disposal by the United Kingdom of government non-commercial zinc stocks, and considerable pressure was exerted on the United Kingdom to restrict these sales which by September 30, 1960, had totaled 35,000 metric tons with 15,000 tons additional to be sold in 1961.

The report noted that in recent years zinc has been characterized by steadily rising world consumption and production and that forecasts for 1960 and 1961 suggested the continuation of this trend. "In considering estimates for 1961," the report continued, "it also should be noted that the anticipated rise in mine production is not as great as that for metal production although United States smelter stocks of concentrates are high. These factors may tend to improve the balance."

The 23-nation study group scheduled its third meeting for Mexico City, Mexico during the latter part of March 1961. ■

## Lead-Zinc Quotas Look Safe For Another Year . . .

The United States Tariff Commission has recommended that no changes be made in existing lead-zinc import quotas set in 1958 by President Eisenhower. This means there is little likelihood of quota revisions or revocation for the next year from the present quota of 80 percent of the average imports for the period 1953 to 1957. Quotas were set on concentrate, slab, bullion etc. ■

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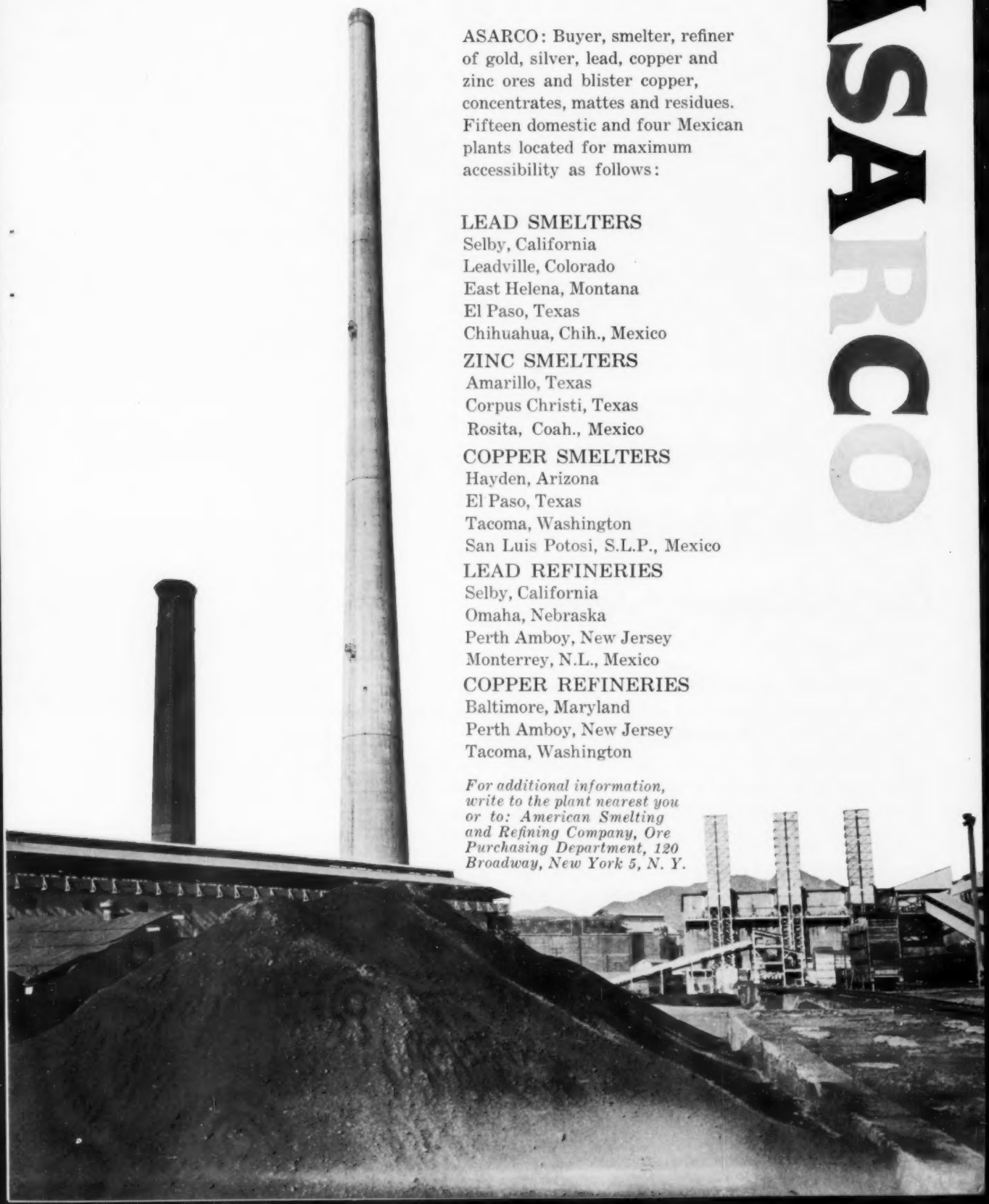
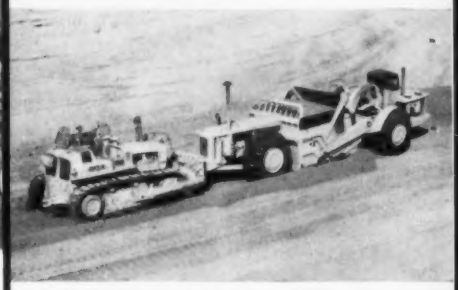


At a coal stripping operation in Pennsylvania, this TC-12 removes overburden at a rate of 400 to 500 yds. per hour. It is equipped with 16' blade...works two 8 hr. shifts a day.



Euclid Twin-Power teams — TC-12 Crawlers and TS-24 Scrapers — move over a million yds. a month at this Wyoming open pit uranium operation.

Model C-6 crawler back-filling overburden in the pit . . . full-power shift, good visibility and fast response make this "Euc" a high production machine for mine and quarry work.

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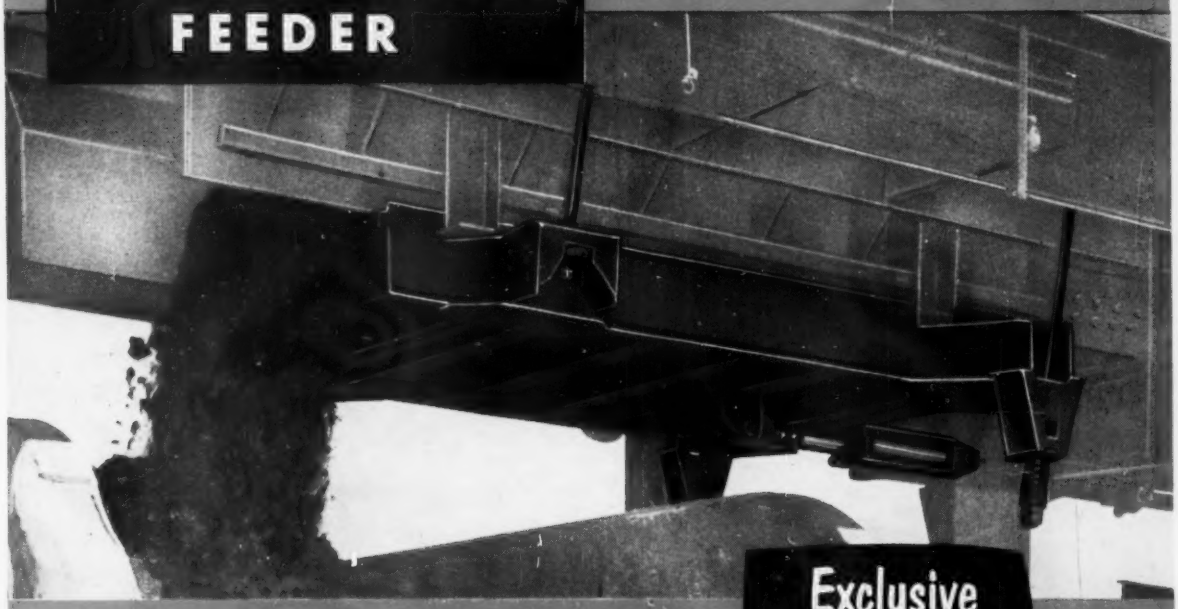


***A Reciprocating High-Tonnage Feeder easily adapted to feed Belts, Trucks, Skips, Railroad Cars, Screens and Crushers***

PATENT APPLIED FOR

**Exclusive HYDRAULIC OPERATION**

**HYDRAULIC OPERATION**

Exclusive hydraulic power drive supplies the fluid to a cylinder which reciprocates the deck. Fixed or variable feeding rates are easily available through the use of a fixed or a variable volume pump. Length of stroke can be varied from 6 to 24 inches.

**MINIMUM HEAD ROOM**

Head room requirements are reduced to as little as 20 inches. Impact damage is minimized because discharge lip of feeder is only 6 to 8 inches above lowest clearance line of feeder. Initial construction costs are reduced.

**ROCKER MOUNTING OR SUSPENSION**

May be installed with either rocker suspension or self-contained rocker mounted units. Eliminates costly wear due to friction which is present in other types of feeders. No lubrication is needed. Feeder can take severe shock loading.

## Durability characterized by special rugged construction

Wide range of sizes available . . . widths from 36" to 96" . . . feeding capacities from 300 to 7500 tons per hour.

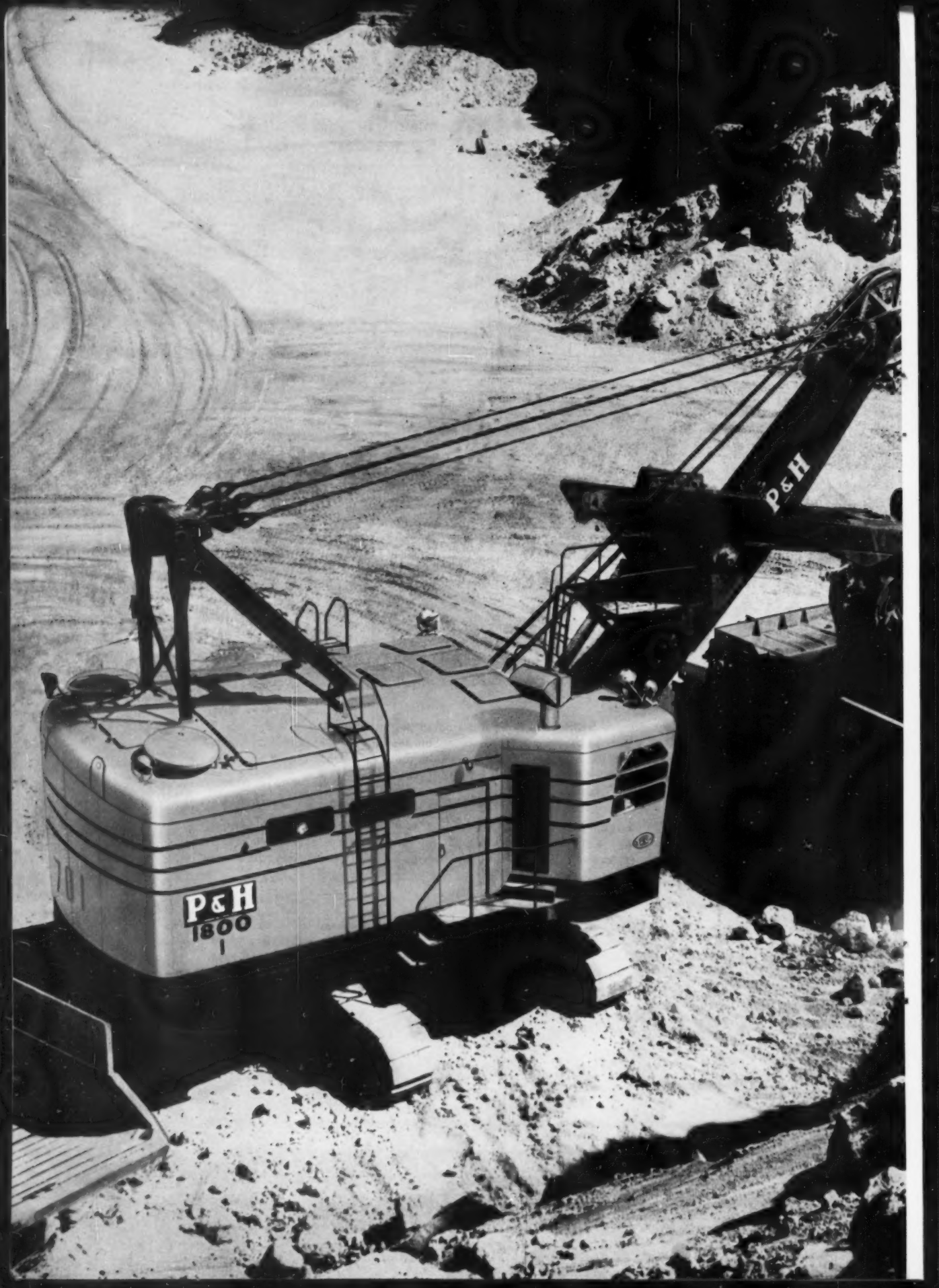
**Write for illustrated brochure.**

®TRADEMARK - REGISTERED

NICO **NATIONAL IRON COMPANY**

50th Avenue West and Ramsey Street Duluth 7, Minnesota

SUBSIDIARY OF PETTIBONE MULLIKEN CORP. CHICAGO 51, ILLINOIS


P&H
P&H
1800

## IF PURCHASES ARE ENDORSEMENTS...

# P&H is the no. 1 choice in copper mining

### Every electric shovel bought for the Southwest by copper companies in the past year has been P&H

Typical of P&H acceptance in copper mining, today you will find *three* or *more* P&H Electric Shovels working at each of 8 out of Arizona's 9 operating copper mines.

P&H has earned such widespread acceptance in the copper mining industry because of lower per-ton loading cost. This profit premium to owners of P&H Electrics results from two basic advantages.

**1. Higher rate of production** made possible by exclusive, patented P&H design principles: MAGNETORQUE® Hoist Drive and Electronic Control.

**2. Vastly superior service and parts availability** reflecting our partnership of responsibility to you, the buyers of our products.

Your satisfaction with these advantages has made us the *World's Largest Builder of Full-electric Shovels.*

**HARNISCHFEGER** **P&H**
*Milwaukee 46, Wisconsin*

# BEST TRACK... BIGGEST SAVINGS

**Allis-Chalmers boosts work hours, cuts costs with the best tractor undercarriage in the business. You get industry's toughest track... best designed track guards ... certified, permanently lubricated truck wheels, idlers, support rollers.**

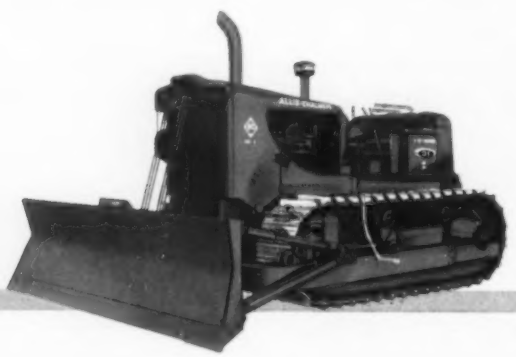
Next time you watch track shoes squeal and grind against jagged rock . . . or see 'em buried sprocket-deep in mud, consider this: Nothing slugs it out with tough conditions like an Allis-Chalmers tractor undercarriage.

Specially heat-treated track shoes, side bars, track pins and bushings are the industry's toughest. Bushings extend into counterbored side bars to seal out dirt, provide more bearing area.

Track guiding truck wheel guards provide a deep-flanged guide channel that keeps track riding true on sprockets, idlers and truck wheels even in the roughest and toughest going. The solid A-frame holds the truck frames in absolute alignment — keeps track running straight.

PERMA-SAFE truck wheels, idlers and support rollers on all Allis-Chalmers tractors roll on tapered roller bearings, are protected against dirt and moisture by Positive Seals. Factory-lubricated, they're certified never to need further greasing.

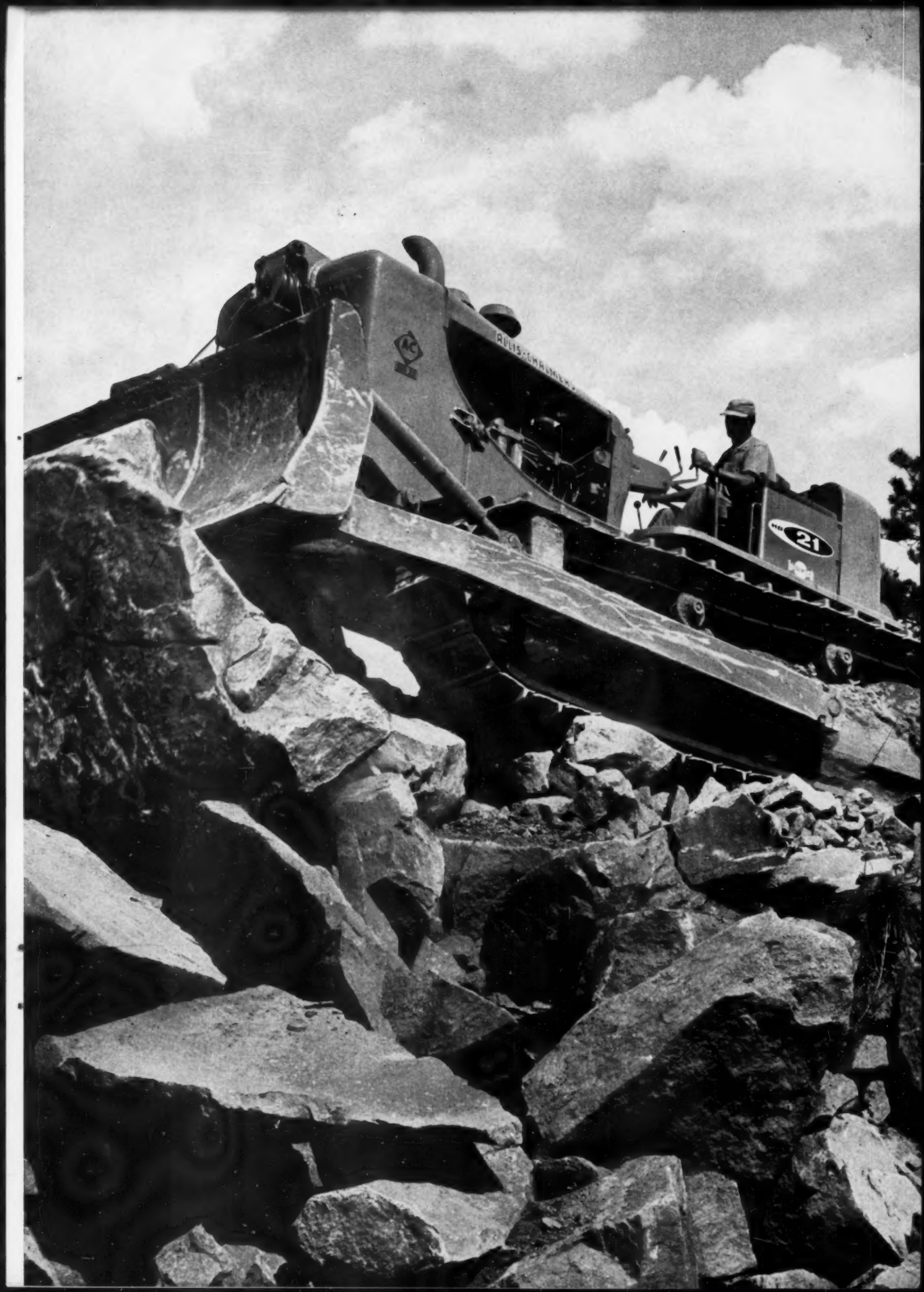
We invite a maintenance cost comparison with any other tractor undercarriage. We further invite you to inspect the Allis-Chalmers healthy, long-lived tractor engine, the all-steel main frame, double-reduction final drives and many other cost-cutting features. Your Allis-Chalmers dealer will be happy to give you full details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

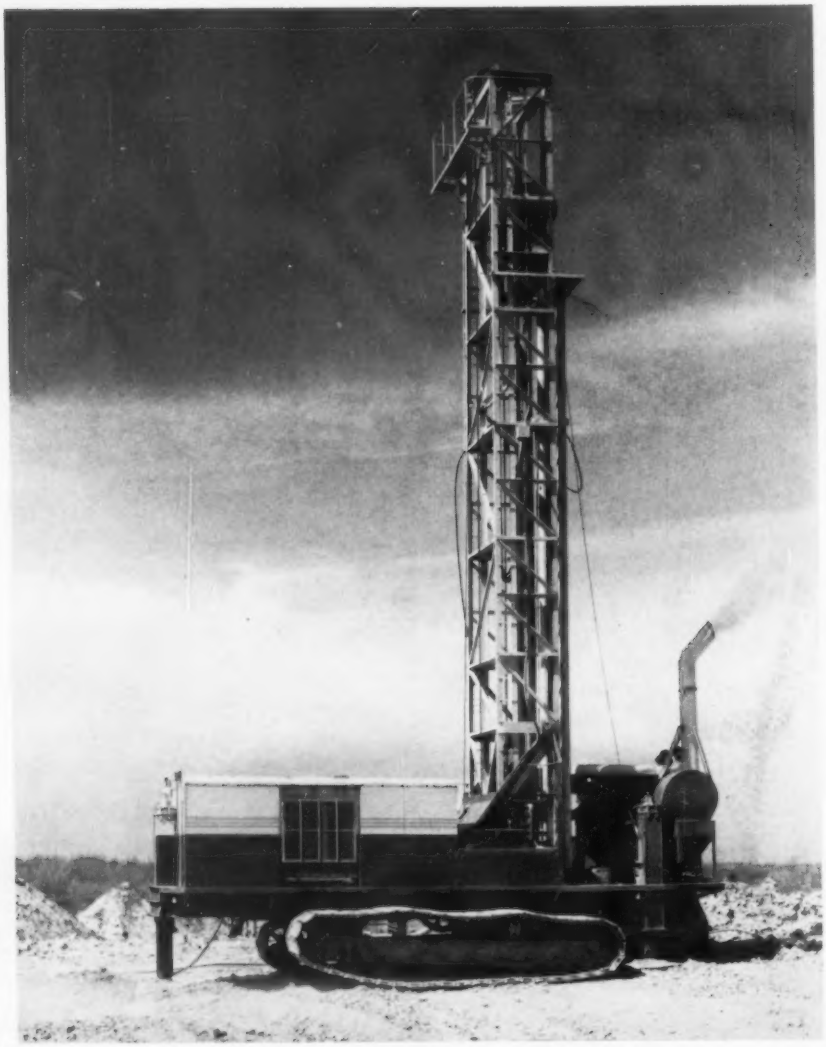


**move ahead with**

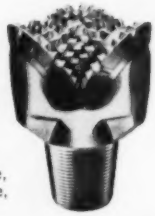
**ALLIS-CHALMERS**

**power for a growing world**


ALLIS-CHALMERS
HD 21



ROTA-BLAST
**RG-2JS**
For extremely hard abrasive rock
(Taconite, quartzite)



ROTA-BLAST
**W7R**
For hard rock
(Siliceous limestone, dolomite, sandstone, granite)

ROTA-BLAST
**OW**
For medium rock
(Limestone, sandstone, sandy shales)

ROTA-BLAST
**OSC-1G**
For soft formations
(Calcite, shale, clay)

# HUGHES "*Rota-Blast*" *Bits* are engineered for mining

Hughes "Rota-Blast" RG-2JS rock bits and rotary drilling techniques, developed in close co-operation with operators and drill manufacturers, are increasing footage and penetration rate 100% and more in areas where blast hole drilling is the toughest.

The engineering and research that developed the RG-2JS for hard formations goes into every size and type in Hughes complete line of "Rota-Blast" rock bits—each engineered specifically for most efficient rotary blast-hole drilling in the kind of formation for which it is designed.

Your Hughes representative can recommend the "Rota-Blast" bit best suited to your operation, and is also qualified to offer you assistance in your drilling program. Behind his recommendations and the bits he sells are the world's largest rock bit manufacturing plant and more than a half-century of specialized rotary rock bit experience.

**HUGHES**
**industrial products**
HUGHES TOOL COMPANY • HOUSTON, TEXAS

# Explosive NEWS From DuPont

FOR
BETTER BLASTING
IN HOLES
AS SMALL AS
THIS!

# INTRODUCING
# Du Pont
# NILITE®
# 101

*Flows freely even in holes as small as...*

# NEW ECONOMY EXPLOSIVE

## you don't have to mix

The minute you tear the corner off your first 50-lb. bag of "Nilite" 101, you'll know you've entered a new era in blasting.

Now at last here is a low-priced, free-running explosive that gives you DuPont quality performance, in shot after shot.

You don't mix "Nilite" 101 on the job. You don't mix it at all. Just rip open the bag and pour it into any hole —small, medium, large—from 2″ diameter up. No clogging, no bridging in the hole.

No clouds of dust, and no ingredient to cause headaches. Ask the men on the blasting crew how they'd like that.

But easy loading is just the first of many improvements you'll find in "Nilite" 101.

It has a rock-breaking wallop you've learned not to look for in "economy" explosives. In fact, you'll get performance equal to that of 60% extra dynamite.

*What else?*

*We've counted 12 ways you'll save time, save money and move more rock per day.*

*They're on the next page...*

**1. LOW COST** The low price of "Nilite" 101, plus the low labor costs (no mixing on the job, no caked and hard-to-pour bags), add up to real blasting economy.

**2. NO MIXING** No oil to buy or store. No costly or potentially hazardous mixing on the job. Just tear open a bag of "Nilite" 101, and pour it into the hole.

**3. NO LOST STRENGTH** Because there's no on-the-job mixing, you don't risk losing strength through ineffective blending which can decrease an explosive's potential strength by 30% or more.

**4. NO CAKING** The particles of "Nilite" 101 are designed to resist setting and caking, even in storage. It stays free-flowing longer than other bulk explosives not so designed.

**5. EASY LOADING** Pours freely into holes as small as 2" in diameter. Fills the entire cross-section of the hole.

**6. NON DUSTING** Even when loading on windy days, there is no dust problem with "Nilite" 101.

# You owe it to yourself to investigate AND PROFIT BY the advantages now possible only with the new

# DU PONT "NILITE" 101

**7. NO HEADACHES** "Nilite" 101 will not cause headaches among your blasting crew.

**8. EASY PRIMING** "Nilite" 101 performs reliably when primed with small dynamite or high detonation pressure primers.

**9. EXCELLENT BREAKAGE** "Nilite" 101 consistently outperforms field mixed blasting agents in producing desired fragmentation.

**10. BETTER PROPAGATION** "Nilite" 101 is considerably more sensitive to propagation than prill/oil mixtures.

**11. GREATER SAFETY** "Nilite" 101 is a true nitro-carbo-nitrate (NCN) blasting agent as defined by the Interstate Commerce Commission, and as such is vastly safer to use than any type of dynamite.

**12. REPRODUCIBLE RESULTS** From shot to shot, you can get dependable results with "Nilite" 101—manufactured under the quality control standards that have established Du Pont explosives as performance leaders in all types of blasting.

UNTIL *YOU* tear open a bag of "Nilite" 101, you'll never know whether you are paying more than you should for each blast.

For a demonstration or a detailed description of Du Pont "Nilite" 101, call your Du Pont Explosives representative or distributor, or send the coupon.

DU PONT "NILITE"® 101

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

**DU PONT EXPLOSIVES DEPARTMENT**
6440 NEMOURS BUILDING, WILMINGTON 98, DELAWARE

Please send me the fact-sheet on your new economy explosive, "Nilite" 101. ☐ I would also like to see a salesman.

NAME .....

COMPANY ..... TITLE .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

**800,000 ton "grind" in Anaconda mills proves . . .**

# Ni-Hard liners good to the last 1/4 inch ...cut mill downtime, slash mill costs

Here's photographic proof from the Montana mines of The Anaconda Co.:

> Ni-Hard liners are good to the last ¼ inch...they keep their contour...they provide a slow, uniform wear rate... they resist abrasion as no other mill liner can.

In twenty of Anaconda's ball mills, this "good-to-the-last-¼-inch" performance saves many thousands of hours of downtime, many thousands of dollars in repair and replacement costs.

The long life and outstanding performance of Ni-Hard* nickel-chromium-iron alloy can do the same for your mills, too. Try a set of Ni-Hard liners in your mills and see for yourself how the abrasion- and wear-resistance of Ni-Hard can cut your downtime, slash your costs, increase your tonnage.

Our detailed 58-page booklet, "Engineering Properties and Applications of Ni-Hard" suggests many other ways to put versatile, long-wearing Ni-Hard to work profitably. For example, to give longer life to feed spouts, pipe elbows, slurry pump liners and impellers, cyclones, and many other parts for ore-processing equipment. Say the word and we'll be glad to send you a copy.

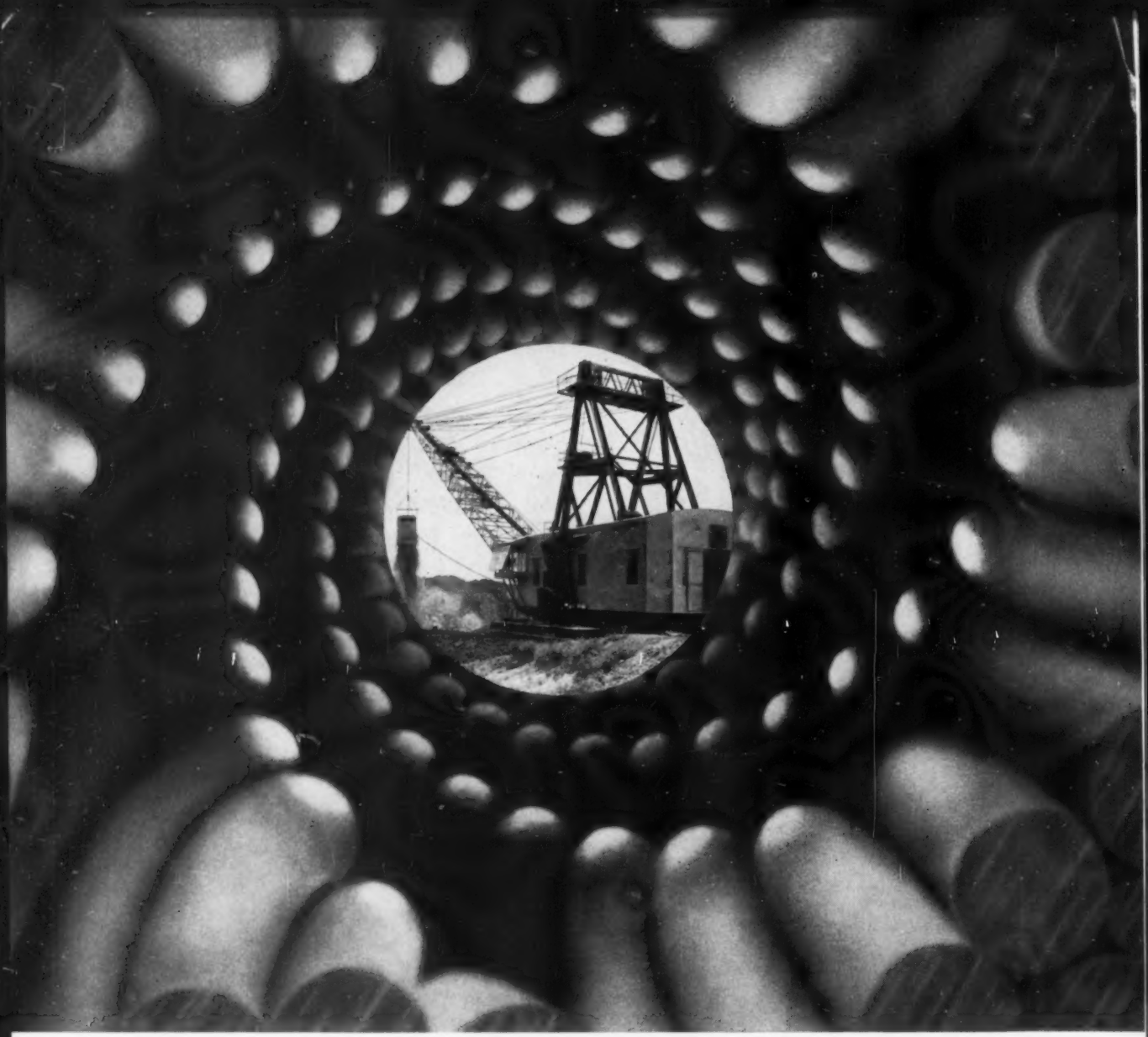
*Registered trademark

**THE INTERNATIONAL NICKEL COMPANY, INC.**

67 Wall Street INCO New York 5, N. Y.

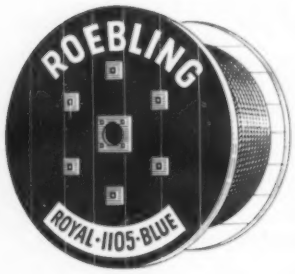
**NI-HARD**

NICKEL MAKES CASTINGS PERFORM BETTER LONGER



## ROEBLING ROYAL BLUE WIRE ROPE

## WE PUT A LOT OF WORK INTO IT—YOU GET A LOT OF WORK OUT OF IT




This happens to be the inside view of Roebling Royal Blue — its core has been removed to show the uniformity and symmetry of the rope structure. You see how concerned we are with internal security.

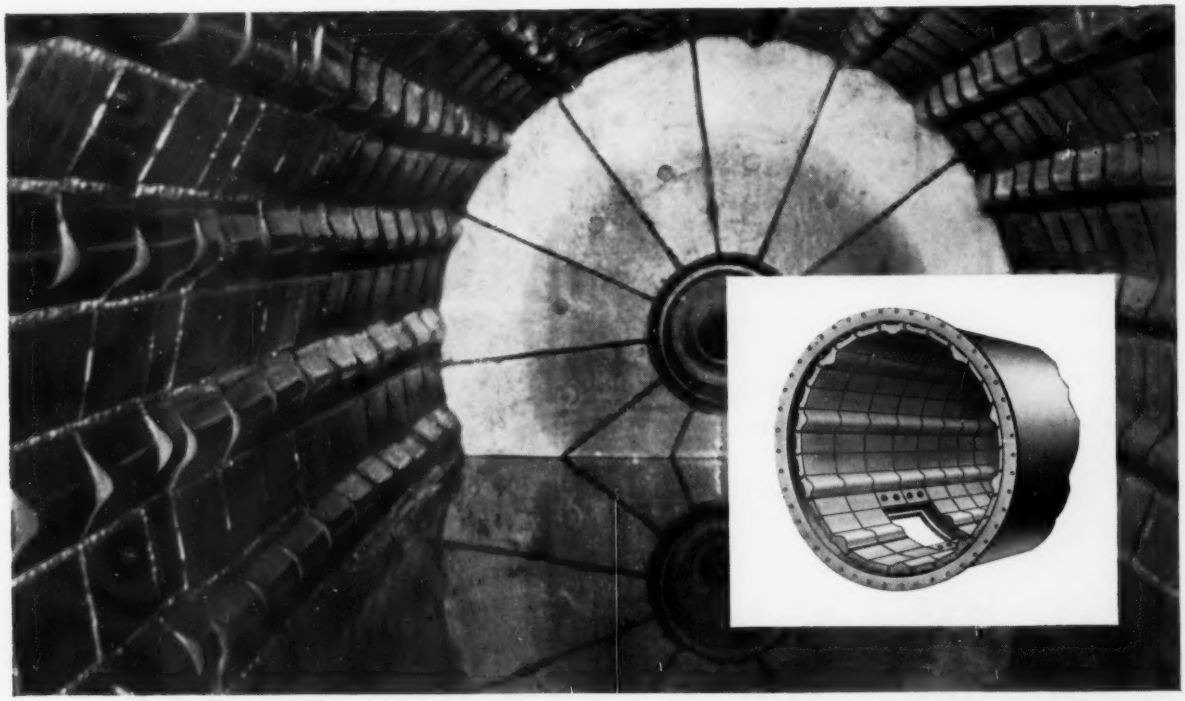
We have to be. To make sure that Royal Blue will live up to the day-to-day demands made upon it. High stresses and unavoidable overloads, abrasion, fatigue, impact, crushing, sheave pressures and abusive drum-winding, to name the major ones.

Royal Blue goes through many inspections and tests—both internal and external —before reporting to work. This way we're sure that the rope we build will do what we sell it to do. These quality-control measures are your assurance that Royal Blue is made to save you money — anyway you look at it.

For details about hard-working Royal Blue, ask your wire rope distributor or write Roebling's Wire Rope Division, Trenton 2, New Jersey.

**ROEBLING**

Branch Offices in Principal Cities • John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation



# 8 Reasons Why You Should Standardize with B&W Universal Liner Plates

## Better Performance with Lower Costs— Same Casting Fits All Mill Sizes

B&W Tube Mill Liners reduce capital, time and labor costs. Consequently, they reduce the cost of the material ground. Here are eight reasons why:

1. Lower Initial Costs—standardization eliminates chiller and pattern costs.
2. Longer Life For Liners—better quality control on a mass production casting, utilizing permanent molds, results in uniform wear. Ideal size for uniform chill and heat-treatment.
3. Longer Life for Different Applications—this is assured by selection of proper materials. Design is suitable for either chilled irons or wear steels.
4. Reduced Costs in Both Direct Labor and Outage —installation time is less because small size and weight of castings allows them to be handled easily, without cranes and with less fatigue for workers.
5. Reduces Costs in Storage Space—because small castings stack easily, little storage space is required. One design of casting interchangeable for all size mills also simplifies records.
6. Reduced Costs in Liner Inventory—standardization is possible because one design fits all diameters of mills. Standardization means quicker unloading and storage.
7. Reduced Costs on Breakage Claims and Delays for Replacements—small castings are rugged and almost impossible to break by handling. Large castings of hard, brittle irons sometimes break in shipment.
8. Reduced Costs in Determining Most Efficient Wear Patterns—you can get wear profiles consisting of all lifter ribs or all flats from the same castings, as well as a combination of both including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates write The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

S-471

# NACO ALLOY BALLS

*through closer metallurgical control*

| ROCKWELL | BRINELL |
|---|---|
| 63 | 710 |
| 61 | 670 |
| 59 | 638 |
| 57 | 601 |
| 55 | 555 |
| 53 | 534 |
| 51 | 495 |
| 49 | 477 |
| 47 | 444 |
| 45 | 429 |

1½ 1⅛ ¾ ⅜

Distance from surface—inches

*tumble per-ton grinding* *costs*

Through precise laboratory controls of the elements in steel making — from spectrographic analysis through final heat treating — Naco Grinding Balls possess the correct structure and hardness for maximum impact absorption and wearing qualities. Structurally, Naco Grinding Balls have a grain akin to tool steel — tough, hard and rugged. Laboratory tests show remarkable uniformity in solidity and controlled hardness holding to desired depth. Every day more mill operators are tumbling to the cost-saving advantages of Naco Grinding Balls.

**CAPITOL FOUNDRY DIVISION**
POST OFFICE BOX 750
PHOENIX, ARIZONA

**NATIONAL** MALLEABLE and STEEL **CASTINGS COMPANY**

*General Offices • Cleveland 6, Ohio*

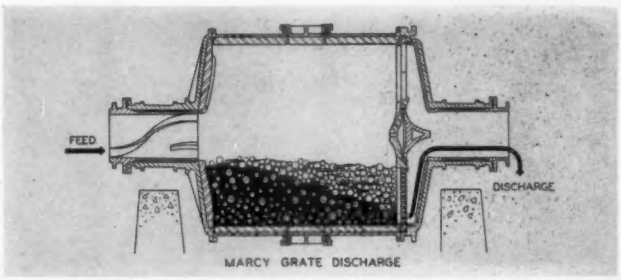
A-1658A

imagination
to originate

experience
to produce...

# IDEAS AND EQUIPMENT FOR LOWER COST GRINDING

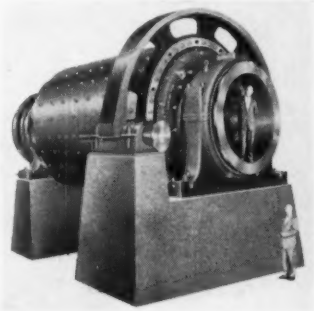
**MARCY MILLS**
are available in 29 different diameter sizes, from 12″ to 12′6″... all proven in the field... all built with mechanical specifications based on proven experience in the field.



MARCY GRATE DISCHARGE

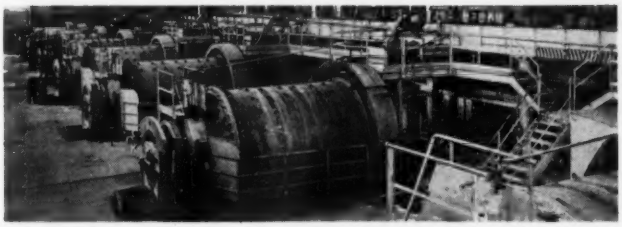
### Low Pulp Line

Mine and Smelter developed the principle of rapid change of mill content with a low pulp line obtained through use of grate discharge in Marcy ball mills and open end feature in Marcy rod mills. This Marcy principle increases tonnage up to 33%; decreases KWH per ton.



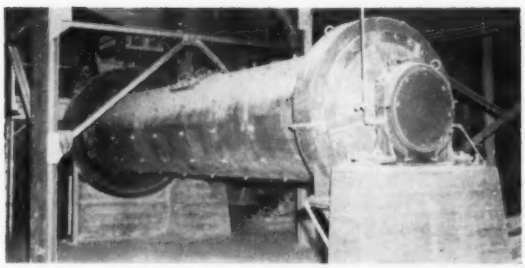
### Large Diameter

Mine and Smelter pioneered the use of large diameter mills to meet the need of specific applications where large tonnage per mill reduced initial cost, provided more efficient grinding, and resulted in a lower overall net cost per ton.



### 2-Stage Grinding

Mine and Smelter's research and experience has resulted in many refinements in the grinding process, one of the most significant being 2-stage grinding... adding Marcy Open End Rod Mills between existing crushing and grinding stages, or replacing fine crushing. This has proven to increase capacity, produce a better ball mill feed, and reduce overall costs.



### Engineering for Special Applications

Engineering grinding mills for specialized applications requires the kind of imagination and experience which Mine and Smelter has developed during the 45 years it has devoted to the art of grinding. Shown is a Marcy Grate Discharge Ball-tube mill, with peripheral discharge, designed for dry grinding high-temperature calcined gypsum from 100 mesh to as fine as 5000 Blaine. This mill provides flexibility in fineness of grind and accurate, convenient means of control.

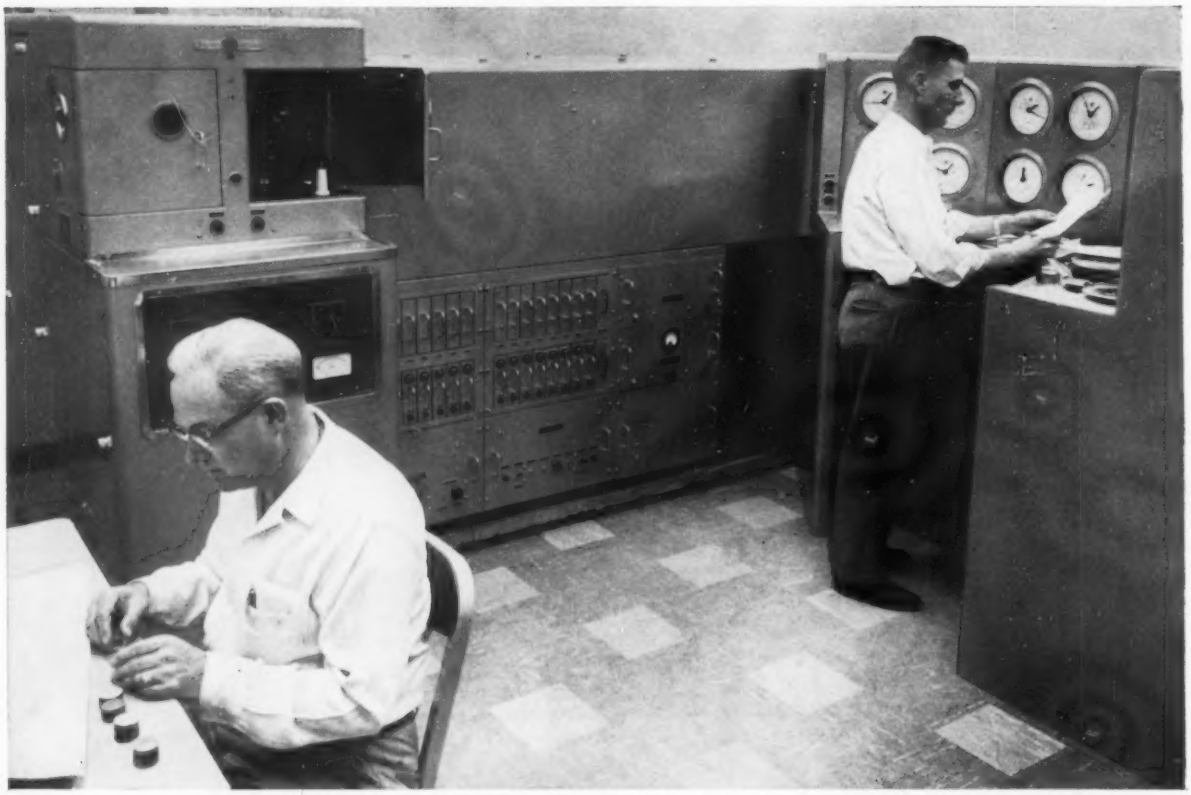
*The Company that cares enough to give you the best!*

*Manufacturing Division*

**MINE AND SMELTER SUPPLY CO.**

DENVER 16, 3800 RACE ST. | NEW YORK 17, 122 E. 42nd ST. | SALT LAKE CITY 1, 121 W. 2nd S. | EL PASO, 1515 11TH AVE. | ALBUQUERQUE, 701 HAINES N.W.

**Licensed Manufacturers and Sales Agents** in Canada, Australia, Sweden, England, South Africa
**Sales Agents** in Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in principal cities of the United States.



**Accurate to one ten thousandth of one percent.** With this new "Direct Reader" Spectrograph, CF&I maintains extraordinary control over each melt of steel. Samples, taken from the blast furnace or open hearth, are sped to the lab via pneumatic tubes. In minutes, a complete spectrographic analysis is ready. This "controlled chemistry" means Grinding Balls and Rods that wear longer, grind more efficiently.

# What CONTROLLED CHEMISTRY means in CF&I Grinding Balls and Rods

CF&I takes great care in the selection of steels used in its grinding balls and rods. For example, each size ball from the smallest to the largest (¾" to 5" diameter) must have the proper composition to give the best balance between hardness and toughness. CF&I's modern spectrographic equipment assures you balls with the correct chemistry in relation to their size. In fact, CF&I uses different steels, depending on the ball size required. This chemical control pays off in your mill because CF&I balls have greater resistance to abrasion, withstand impact, and grind at lower cost.

In grinding rods, CF&I observes similar standards. Special analyses of high carbon steels are hot-rolled and machine-straightened to close tolerances, from 1½" to 4" diameter in whatever lengths ordered. CF&I's controlled chemistry techniques result in grinding rods that have excellent wearing properties, resisting bending or premature breakage.

For the complete story on the advantages of CF&I Grinding Balls and Rods, get in touch with your local CF&I Sales Office.

**Other CF&I Steel Products for The Mining Industry**

CF&I Mine Rail and Accessories • CF&I Rock Bolts • Realock Metallic Fabric
CF&I Industrial Screens • CF&I-Wickwire Rope • CF&I Grader Blades

CF&I STEEL

**MINING PRODUCTS**

**THE COLORADO FUEL AND IRON CORPORATION**

7525

*In the West:* **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso • Ft. Worth • Houston Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Leandro • Seattle • Spokane • Wichita
*In the East:* **WICKWIRE SPENCER STEEL DIVISION**—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia

# Drill hard rock faster with your rotary rig and the

# GARDNER-DENVER "MOLE-DRIL"®

Now—add new versatility to your rotary drilling rig with the Gardner-Denver "MOLE-DRIL"* in three sizes: AM4 (4″ dia.), AM5 (5″ dia.) and AM6 (6″ dia.).

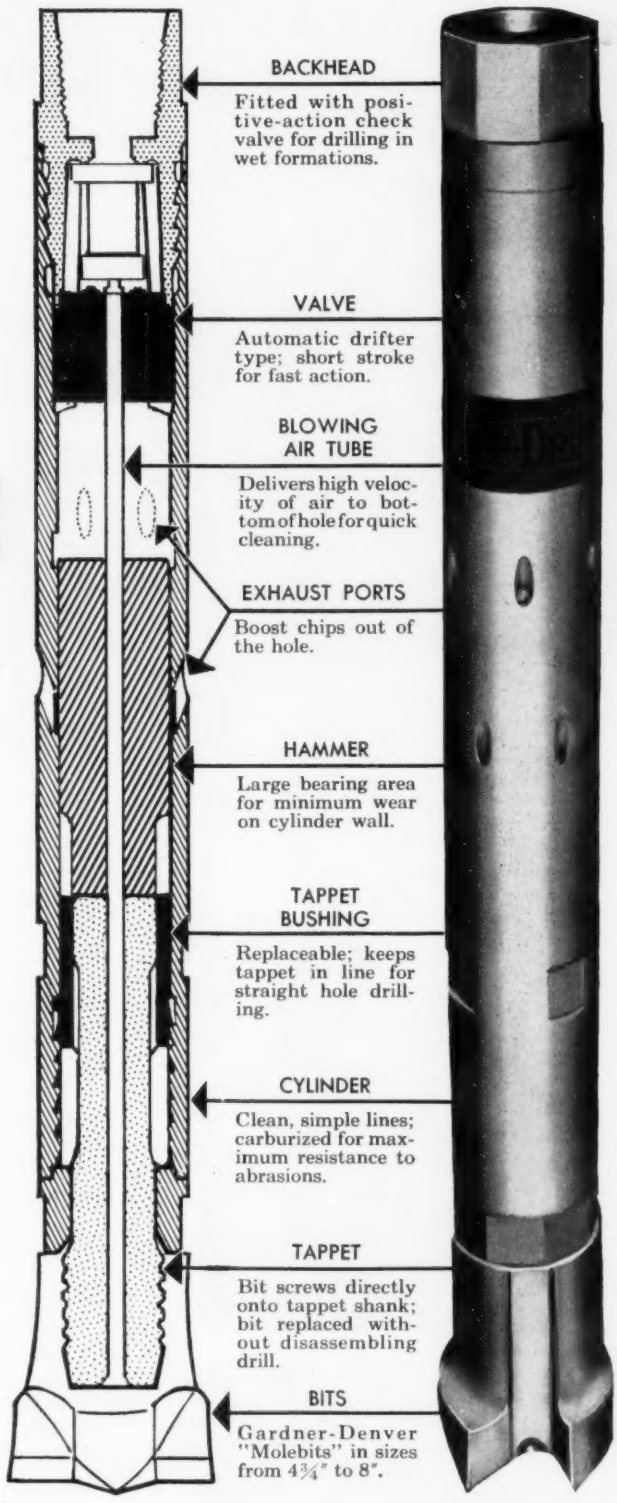
Add new power for fast hard-rock drilling with the heavy-duty, percussion-type "MOLE-DRIL." It screws directly onto your drill pipe . . . works at the bottom of the hole right at the rock face. There's no power-draining rod between the hammer and the bit.

### *ONLY 3 MOVING PARTS*

Rugged construction cuts down time. Simple design reduces wear and trouble. Only three moving parts: valve, hammer and tappet. Compare these Gardner-Denver "MOLE-DRIL" features right down the line:

*FOR FULL DETAILS,*
*WRITE FOR BULLETINS.*

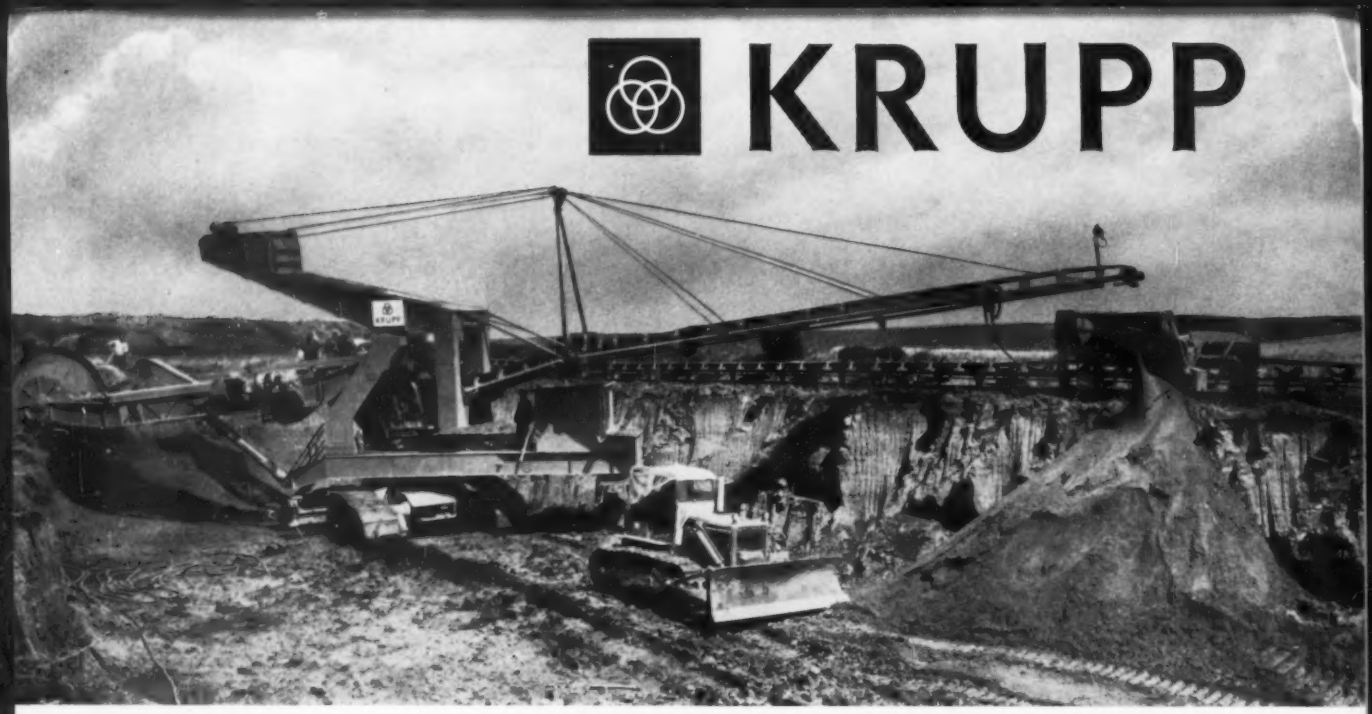
**Trade-Mark*


BACKHEAD
Fitted with positive-action check valve for drilling in wet formations.
VALVE
Automatic drifter type; short stroke for fast action.
BLOWING AIR TUBE
Delivers high velocity of air to bottom of hole for quick cleaning.
EXHAUST PORTS
Boost chips out of the hole.
HAMMER
Large bearing area for minimum wear on cylinder wall.
TAPPET BUSHING
Replaceable; keeps tappet in line for straight hole drilling.
CYLINDER
Clean, simple lines; carburized for maximum resistance to abrasions.
TAPPET
Bit screws directly onto tappet shank; bit replaced without disassembling drill.
BITS
Gardner-Denver "Molebits" in sizes from 4¾″ to 8″.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

## GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
International Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario



KRUPP

# Bucket Wheel Excavator

**Type Sch Rs $\frac{100}{0,4}$ × 9.5 Crawler-Mounted with Electric Drive**

▼ Bucket wheel is equipped with seven buckets. A switch gear permits selection between two speeds for wheel rotation.

▼ Bucket Wheel Excavator, Sch Rs $\frac{100}{0.4}$ × 9.5, digging a cut

Bucket wheel excavators are continuous duty equipment assuring a steady flow of excavated material.

The digging tool is a wheel which, in the present type, has seven buckets attached to its circumference. Bucket content is 3.5 cu.ft. each.

This bucket wheel only does the actual digging work, while further haulage of material up to the loading point is done by means of economically working conveyor belts.

A switch gear will permit selection between two speeds for bucket wheel rotation.

The bucket wheel boom and loading boom can be slewed independently. Bucket wheel boom is raised or lowered hydraulically.

This type of excavator, with the rotating wheel slewable in generally horizontal plane, is suited especially well for digging of stratified materials. Whereas bucket wheel excavators were first used mainly in open cast mines for mining and digging of overburden and minerals, they can now be seen already on the most various excavation sites, working on removal of elevations, digging cuts, canals, or basic layouts for roads and railroads.

The excavator shown here can cut in a width of 47 feet per block, at a cutting height of 31 feet. The excavator is fully electrified. It travels on two crawlers, at a speed of 20 feet per minute. Altogether, nine drive motors are installed, with a total power rating of 138 kW. Versatility in operation and low operating cost are the predominant characteristics of this excavator.

KRUPP excavators and bulk handling plant are working all over the world, under the most severe climatic conditions — in Canada and South Africa, in the United States, Australia, India, Indonesia, in the Congo or Morocco, in Greece and Yugoslavia, Italy, France, England, Ireland, Poland, Russia and Germany.

**This type of bucket wheel excavator was exhibited at the 1960 American Mining Show, Las Vegas, Nevada**

FRIED. KRUPP MASCHINEN- UND STAHLBAU RHEINHAUSEN

For information, please contact Krupp International Inc., 375 Park Avenue, New York 22, N. Y.

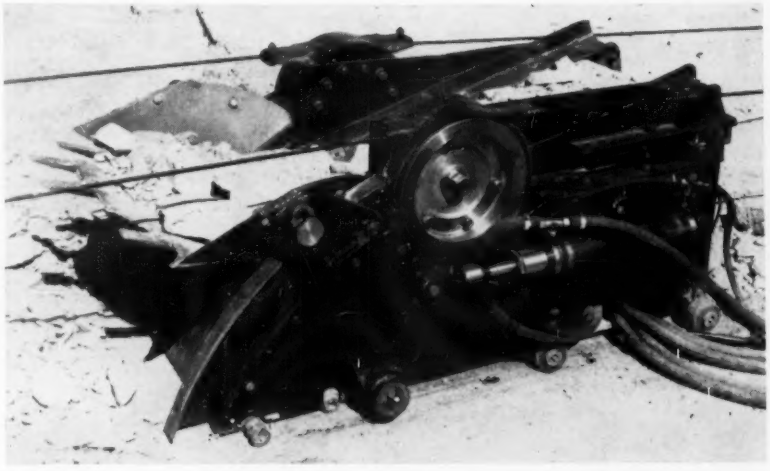
# New Blair Mucker for Inclined Stopes Only 30-Inches High

Robert Blair, chief consulting mechanical engineer for Anglo American Corporation of South Africa, Limited, has developed a new loading machine that will operate efficiently in flat dipping stopes only 39 inches high. However, the machine will operate in stopes of any greater height with the footwall at any angle less than the angle of repose of broken ore. Actually, the steeper the footwall, the more efficient is the loader.

The first experimental loader pictured here was built in Johannesburg, Union of South Africa, and could have a mucking capacity from 50 to 60 tons per hour depending on the size and type of broken muck.

This prototype loader is 2 feet 7⅝ inches high, 3 feet 4 inches wide, and 7 feet 1¾ inches in over-all length. It weighs only 2,000 pounds and uses two 3.5 horsepower air motors.

Two basic design features make this loader different and efficient. They are: (1) method of loader travel and crowding into muck pile, and (2) the use of a backless bucket. The loader moves back and forth on the two parallel steel cables shown in picture. Each cable is wrapped three times around each drive pulley or drum. By turning the pulleys with compressed air motors through a gear train, the loader winds itself ahead into muck pile or winds itself back. There is a 10 to 1 drive ratio on pulleys so a small motor can achieve



tremendous crowding action into the muck pile. Thus, propulsion is based on the Blair stage hoist friction drive. The motors can be independently operated so that a slewing angle of 60 degrees is easily achieved to load a muck pile three times the width of the machine.

The two cables are anchored to stope or raise face ahead of machine. A pneumatic cylinder anchors the tail end of each cable to give spring or resilience to cables, yet holds them tight enough to serve as guides and produce the friction effort.

The back of the bucket is actually an immovable, curved steel plate fastened to frame. The muck rides against this plate as the bottom or lip of bucket is raised through an angle of 32 degrees. At top of arc muck is thrown and slides out of bucket onto a belt set at 18 degree slope.

The loader can be built for either skid mounting, rubber or steel wheels, or Caterpillar type tracks. Independent motors can also be used.

The most exciting use for this loader might well be its incorporation on the front end of a shuttle-type car, or so-called slusher train, to make an integral loading and haulage unit.

All patent rights have been applied for by Anglo American.

# Iron ore to metal by partial reduction and electric furnacing

A new ironmaking process—the Dwight-Lloyd McWane – requiring about one-third the investment per ton and capable of matching or bettering production costs of conventional high tonnage processes, has been developed.

Robert C. McDowell, president of McDowell Company, Inc. reports that, "A single unit D-LM plant producing about 500 tons of pig iron per day will cost between $6,000,000 and $7,000,000 to build. This represents a capital cost between $35.00 and $45.00 per net ton." Operational costs depend on many factors, but are estimated from $39.00 to $47.00 per net ton of iron. A modern blast furnace and coke plant require an investment of approximately $90.00 per net ton of capacity.

The new process uses mixtures of fine ores or concentrates, fine coal, and limestone which are properly proportioned and pelletized in a Flying Saucer. Pellets are fed to a Dwight-Lloyd sintering machine where partial reduction is accomplished. The sintered pellets, self-fluxing and self reducing, are fed to an electric furnace at 1,500° C. for final smelting.

Key to the process is partial or pre-reduction of the iron at lower than conventional smelting heats to produce a hot balanced charge for low cost final reduction in an electric furnace where smelting could be carried on continuously or intermittently.

Product metallurgy can be controlled closely because of fast reaction times and the flexibility of the operation. Basic hot metal, pig iron, white cast iron, grey cast iron, and silvery pig iron can be produced with facility and the process lends itself to ferroalloy production.

The new process will not replace existing blast furnaces, but will find use for small operations to produce high grade iron from low grade raw materials. It does not require coking coal and the electric furnace uses only 900 kilwatt hours per ton of iron.

# Basic Incorporated Increases Magnesite

There is a lot of activity this year at Gabbs, Nevada, where Basic Incorporated has been building new facilities to increase magnesite production. A new flotation section is now processing 500 tons of magnesite ore a day. A new 200-foot rotary kiln, just installed, will increase dead burned magnesite production 40,000 tons a year. A special refractories plant has been built to produce the many diversified magnesite products for which Basic Incorporated is so well known.

Located in the foothills of the Paradise Range in Nye County, Gabbs is 147 miles southeast of Reno and about 31 miles north of Luning. The modern townsite of Gabbs and the plant of Basic Incorporated are at an elevation of 5,000 feet with the open pit operations 1,000 feet above.

Brucite, a magnesium hydroxide mineral, was first discovered in the Gabbs area in 1927. Magnesite, the magnesium carbonate, was found later in the area on tungsten claims. Exploration soon delineated total magnesite reserves, containing less than five percent lime, as more than 25 million tons. These ore bodies occur in Upper Triassic dolomites over an area four miles long by two miles wide. The beds are complexly folded, faulted, and intruded by a variety of dikes and granodiorite stocks.

All magnesite mining at Gabbs is by open pit methods. From 2,500 to 4,000 tons of ore and waste per day are selectively mined from 10-foot high benches. In order to obtain proper control of the ore, it was found necessary to limit the bench height to this relatively low figure. Blasthole drilling is done with two Gardner Denver Air Trac drills and two Joy 350 wagon drills using tungsten carbide bits. Blastholes are drilled 12 feet deep on a 6½ foot square pattern. This spacing and depth insures a good pit floor for the benches and good fragmentation.

Blasting is done with fertilizer grade ammonia nitrate

PLANT BUILDINGS at Gabbs operations of Basic Incorporated. Raw ore stockpiles are in right foreground.

DRILLING blast holes at edge of the open pit. For selective mining and ore control bench heights are ten feet.

## Low grade magnesite ore with high lime and silica content is

Ore at the crushing plant is reduced in three stages. Primary work is done by a 36-inch Superior McCully gyratory crusher which reduces the ore to 5-inch size. Secondary crushing is done with a 4-foot Symons standard cone which reduces the ore to 1.5- to 2-inch size. Sizing is done with two double deck 600 Ty-Rock Tyler screens. Most of the fine material (minus ⅜-inch) goes to waste. In this way the silica content of the ore is often reduced from 4 percent to 2 percent. A movable belt stacker next conveys the crushed ore to several mill stockpiles. Each stockpile contains ore of different grades and total storage capacity is more than 100,000 tons. A concrete tunnel 480 feet long is located under the stockpiles. Ore is fed to a 24-inch conveyor belt in the tunnel by a movable feeder that draws from 38 drawholes. The conveyor carries the ore to a 5½-foot Symons Short Head cone crusher that produces a minus ½-inch product. Crushed ore is then stored in feed storage bins.

Low grade ore from the stockpile that has a high lime and silica content is now sent to the new flotation section of the plant for removal of impurities. This new 500 ton-per-day flotation section was designed and built by The Stearns-Roger Manufacturing Company of Denver, Colorado, and went into operation last year. High impurity ore from the 750-ton storage bin is ground in a 6- by 10-foot Allis-Chalmers ball mill in closed circuit with a 78-inch by 28-foot Wemco classifier. Reagents are added to the slurry in two steps with two 8-foot conditioners. The feed is then passed to 18 Morse-Weinig flotation machines in two parallel banks. There are six 42-inch rougher cells, six 42-inch cleaners, and six 42-inch recleaners.

The concentrate is next pumped to a 50-foot Dorr thickener, and thence to an 8-foot 10-inch Peterson filter with seven discs for final dewatering. The filter cake goes to a surge bin where a screw conveyor feeds it into a 90-inch by 60-foot Ruggles-Cole rotary dryer. This concentrate is stored in two 340-ton bins.

Approximately one third of the concentrate production

# Production at Gabbs, Nevada

sensitized with seven pints of diesel fuel oil to every 80 pounds of nitrate. Holes are primed with one stick of dynamite and an electric blasting cap. From 400 to 1,000 holes are shot at one time. Since good fragmentation is obtained, secondary blasting is seldom necessary.

Loading of broken material is done with a 2½ cubic yard Bucyrus-Erie diesel-powered Model 54-B shovel. A Caterpillar D-6 Angledozer is used for clean-up around the shovel. Haulage units consist of six 15-ton Euclid trucks powered with 165 hp Cummins Diesel engines. Since ore is hauled over two miles downhill to the crushing plant, hydrotarders and Williams compression exhaust brakes are standard equipment on all trucks.

Because poor grades or magnesite ore are not readily distinguishable from better grades, the chief means of maintaining quality is chemical analysis. All cuttings from drill holes are analyzed for lime and silica. Analyses are plotted on maps and contour lines are drawn through points of equal lime content. Contour intervals are chosen to correspond to the various grade limits. When the several grade intervals are represented by different colors, a second set of contours can be superimposed to show the distribution of the silica. Any particular grade of ore can then be selected by following the colored area representing the lime limits around to where it is bounded by contours representing the silica limits.

Magnesite ore containing less than 2 percent silica and less than 2.5 percent lime is considered high grade. Low grade ore will run up to 20 percent lime and 15 percent silica. Due to the complex nature of the ore body, both lime and silica contents may vary widely within a short distance. Since a few truckloads of high lime or high silica material can seriously dilute good magnesite ore, quality control in the pit is of major importance.

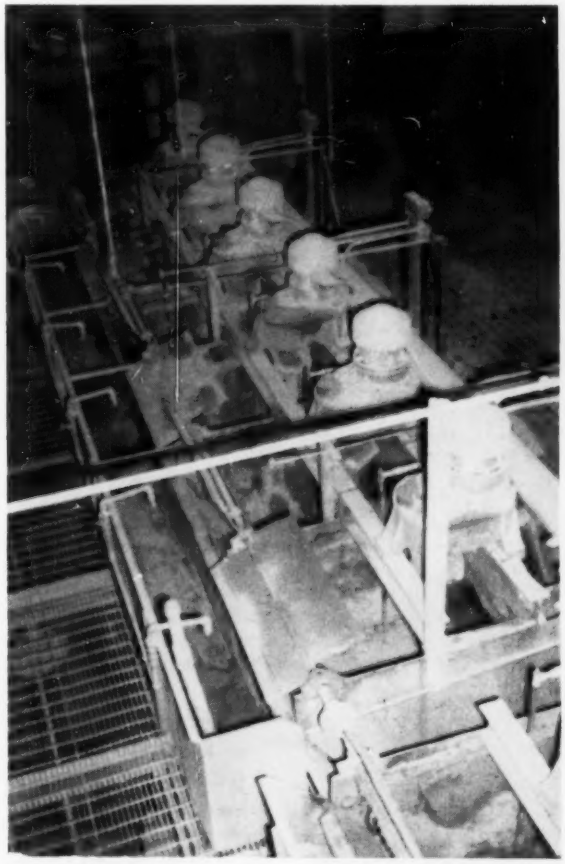
LOADING magnesite ore with 2½ cubic yard shovel. Chemical contour maps guide mining operations in pit.

## now concentrated by flotation

from the flotation section is sent to be calcined in a Herreshoff furnace. The balance of the concentrate together with some of the calcine is briquetted and the briquettes are fired in a rotary kiln to produce dead burned magnesite or crystalline refractory periclase.

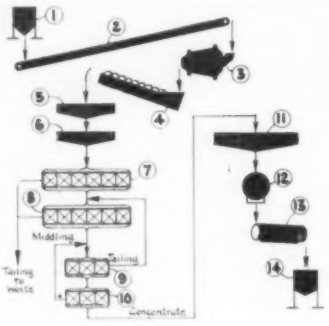
Light burned magnesium oxide or caustic calcined magnesia is made by calcining magnesite in a 14-hearth Herreshoff furnace of 22 foot diameter. Furnace feed is both concentrate from the flotation section and/or high grade magnesite ore from the mill stockpile. There are two Herreshoff furnaces and each produces approximately 90 tons of calcined magnesite a day.

From the storage bins magnesite ore and/or concentrate is conveyed by belt and bucket elevators to the top hearth of the furnace. For quality control the feed rate to the furnace must be maintained at a steady flow. This is accomplished with a Hardenge constant weight feeder placed under the feed storage silo. As the feed moves across the 14 different hearths, and downward through the furnace,



ROUGHER CELLS in flotation section of plant. Eighteen cells produce 500 tons of magnesite concentrate a day which is either calcined or briquetted to dead burned magnesite.

Continued overleaf




1. Storage bin, 750 ton. 2. Belt conveyor, 24 inches by 28 feet. 3. Ball mill, Allis-Chalmers, 6.5 by 10 feet. 4. Classifier, Wemco, 78 inches by 28.5 feet. 5. Conditioner, No. 1, 8 by 8 feet. 6. Conditioner, No. 2, 8 by 8 feet. 7. Flotation machine, 6 rougher cells, 42 by 42 inches. 8. Flotation machine, 6 first cleaner cells, 42 by 42 inches. 9. Flotation machine, 3 second cleaner cells, 42 by 42 inches. 10. Flotation machine, 3 third cleaner cells, 42 by 42 inches. 11 Thickener, Dorr-Oliver, 50 feet diameter. 12. Filter, Peterson 7 disc, 8 feet 10 inches. 13. Dryer, Ruggles-Cole, 90 inches diameter by 60 feet long. 14. Concentrate bins, two 20 by 28 feet, 340 ton capacity.

BASIC INCORPORATED, WESTERN DIVISION
Flotation Plant Flowsheet – Gabbs, Nevada

CRUSHING PLANT reduces magnesite ore in three stages with gyratory and cone crushers plus double deck screens.

it is heated at a carefully controlled rate. As the feed passes through the higher temperatures of the lower seven hearths, the desired degree of calcination is obtained. The time required for material to travel through the furnace is approximately 2½ hours depending on the reactivity desired in the product

Furnace discharge goes directly into a Stearns-Roger cooler. Entering at about 800 degrees F., the calcine passes through water-cooled inner tubes and is discharged at about 150 degrees F.

The caustic calcined magnesia as produced from the Herreshoff furnaces is sold by Basic Incorporated under the trade name of Magox. Typical analyses of two grades of Magox, one made from selected ore and the other from concentrates, on a loss-free basis, are:

| | *Magox 90* (*Selected Ore*) | *Magox 96* (*Concentrates*) |
|---|---|---|
| $SiO_2$ | 3.7% | 0.8% |
| $Fe_2O_3$ | 0.6% | 0.4% |
| $Al_2O_3$ | 0.5% | 0.3% |
| CaO | 3.5% | 1.3% |
| MgO | 91.6% | 97.0% |

Magox is used in uranium processing, as a binder in the manufacture of building materials, in paper mills, and for a number of other chemical applications.

In addition to producing some 30,000 tons annually of the above described calcined magnesite, the Gabbs operations of Basic Incorporated also produce 80,000 tons annually of high magnesia refractory clinker. With the recent installation of a second rotary kiln this production has now been increased to 120,000 tons a year.

To produce the granular refractory clinker, powdered concentrate from the flotation section or high grade ore from the stockpile is used. Ore is dry ground to minus 65 mesh and transported by air slides to Fuller blending tanks. The mix then goes to pug mills where water and binding materials are added, then to briquette presses, to a dryer, and finally into briquette storage bins. The briquettes are fed from these bins into the oil-fired rotary kilns. Here the temperature of the material is raised to about 3,100 degrees F. From the kilns the clinkered material passes through a Fuller cooler, and is then crushed and sized. The hard, dense, crystalline clinker is stored in six 1200-ton bins for eventual shipment to consumers, or to Basic's refractory plants.

The older rotary kiln at the Gabbs operation was manufactured by the Trayler Engineering Company and is 400 feet long with a 9-foot 6-inch inside diameter. It is a production capacity of 80,000 tons of clinker a year. The new kiln, completed in August of this year, was manufactured by Allis-Chalmers and is 220 feet long with an 8-foot inside diameter. It has an annual clinker production capacity of 40,000 tons. With the addition of this new kiln, operations are more flexible.

The clinker, or dead burned magnesite, production is made with different chemical formulas and is crushed to several different sizes depending on specific requirements of customers. It is used in the maintenance of high temperature furnaces and in special refractory products.

Much of the clinker production of Gabbs is sent to a large refractories plant of Basic Incorporated at Maple Grove, Ohio, where it is transformed into special refractory products, a substantial tonnage of which is returned to west coast markets. To supply these growing western markets and to eliminate the 1,500 mile trip to Ohio, a special refractories plant is being built at Gabbs. This plant, which will cost about a half million dollars, has been designed to Basic's specifications by the MacDonald Construction Company of Chicago, Illinois and erected by personnel from its San Francisco office. END

**Operations at the Nevada Works of Basic Incorporated are headed by H. P. Willard, (left) Manager of Western Operations; A. M. Dixon, Mine Superintendent; Robert W. Gates, Mill Superintendent; J. F. Jankovic, Works Engineer and Maintenance Superintendent.**

**Here are the Costs for Three Missouri Shaft Grouting Jobs**

| Item | Meramec No. 1 | Viburnum No. 28 | Meramec No. 2 |
|---|---|---|---|
| Total grout hole footage | 4,700 | 8,600 | 5,210 |
| Depth of holes, feet | 40 | 88 | 60 |
| Flow from first test hole, gallons per minute | 60 | 60 | 200 |
| Static formation pressure, pounds per square inch | 300 | 260 | 350 |
| Thickness of permeable layer, feet | 20 | 45 | 34 |
| Horizontal area within grout curtain, square feet[1] | 615 | 950 | 615 |
| Volume of rock within grout curtain, cubic feet | 12,300 | 42,700 | 20,900 |
| Sinking delay, days (3-shift basis) | 6 | 24 | 20 |
| Man shifts | 180 | 576 | 600 |
| Gallons pumped | 5,500 (10% AM-9) | 43,500 (7½% AM-9) | 28,300 (7½% AM-9) |
| AM-9, pounds | 4,570 | 27,200 | 17,700 |
| Saving with 7½% AM-9 | — | $7,900 | $5,100 |
| Cost of chemical grout | $4,250 | $29,000 | $16,700 |
| Total estimated direct cost | $10,650 | $44,400 | $33,700 |
| Cost per cubic foot of protected rock section | $0.87 | $1.03 | $1.60 |

*1. Horizontal section taken at mid-point of outer ring of grout holes, i.e., taken at half their depth.*

**Here Are the Costs For Chemical Grout**

Closely estimated costs for the chemical grouts used by St. Joe are as follows:

| | |
|---|---|
| 7½% AM-9 | $0.58 per gallon |
| 10% AM-9 | $0.67 per gallon |
| Terra Firma, 5:1 mix by weight | $0.24 per gallon |

In comparing these costs with those of cement slurries, it should be remembered that the cost of grout volume *in place* is the important thing. Under conditions where chemical grouts are considered, only very thin slurries would be feasible, and several gallons of grout would be required to produce one gallon of grouted volume *in place*.

# How Research Advances Grouting Techniques at St. Joseph Lead

For the past three years, the Mine Research Department of St. Joseph Lead Company's Southeast Missouri Division has endeavored to put grouting operations on a more scientific and quantitative engineering basis. This has been done in four ways:

1. All available published information on the subject, both from this country and abroad, is collected for study and quick reference. Close personal contact is maintained with the manufacturers of new grouting materials.

2. Laboratory and purely experimental installations underground are used to test and develop combinations of materials, new materials, and special techniques in advance. This preparation is of inestimable value when operations encounter new, complicated, and potentially dangerous ground water problems.

3. Complete written reports of each major grouting job done within the district are placed in a grouting "notebook", so that operating personnel may always know what was done, and exactly how it was done. This assures continuity of knowledge and eliminates much of the wasteful trial and error struggle with which many new grouting operations inevitably start, especially with a supervisor and/or crew inexperienced in grouting.

4. Mine research personnel are assigned the task of planning, and in most cases supervising, the major grouting programs. On smaller jobs they serve as consultants. This arrangement provides all-important continuity of experience.

Because cement grouting has long been regarded as much more of an art than a science, most of the Research Department's effort has been directed toward application of the new chemical grouts.

Chemical grouting was first studied seriously by the St. Joseph Lead Company in 1958, when it became apparent that new techniques would be necessary if the shafts of the newly discovered lead deposits at Viburnum, Missouri, and the joint iron ore development with Bethlehem Steel Company near Sullivan, Missouri, were to penetrate the highly permeable, water-bearing Lamotte sandstone. This sandstone is competent, with an average grain size of 0.25 millimeters, and lies at a depth of 850 to 1,100 feet below surface in the areas mentioned. Thickness runs from 100 to 150 feet, and void space is 10 to 15 percent.

Long before the first shaft of Meramec Mining Company penetrated the Lamotte formation at the iron ore project, numerous laboratory and field experiments tested various grouts in the sandstone. Freezing was quickly rejected as uneconomical, and all cement-clay-bentonite-fly ash slurry grouts proved ineffectual in penetrating the very small interstices. Finally, American Cyanamid's chemical grout, AM-9, was chosen as being the quickest, simplest, and easiest way to seal this particular formation. Working closely with Cyanamid personnel, complete plans were outlined, including a grouting pattern, necessary equipment, a means of determining how much chemical to put in each hole, gel time, pumping rate, and injection sequence. In all three major chemical grouting jobs done in this district, it has been the practice to probe the formation ahead of the shaft with a diamond drill test hole. Flow from the hole is metered at 5 or 10 foot intervals, and all core tested for permeability. These test holes have been invaluable in planning the jobs.

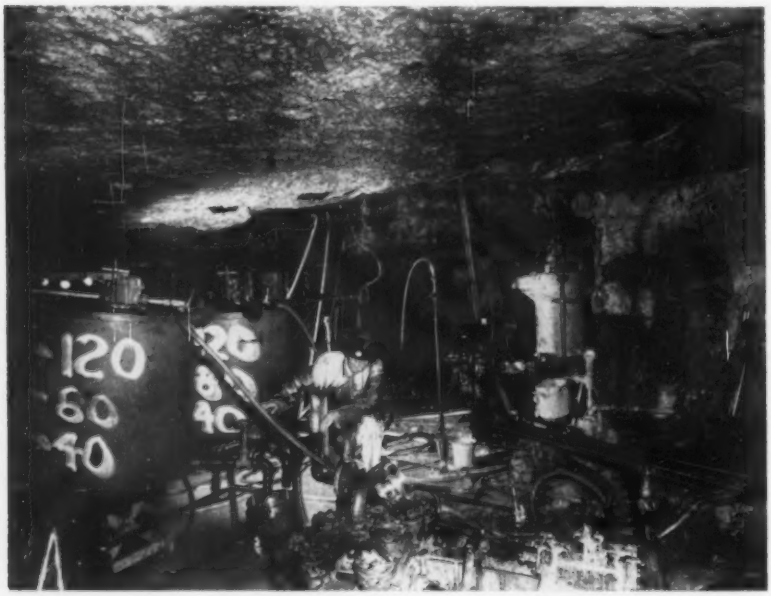
**Continued overleaf**

**by John J. Reed and Lee Bilheimer**

**Mr. Reed, now professor of mining engineering at the Colorado School of Mines, was formerly head mine research engineer for St. Joseph Lead Company. Mr. Bilheimer is mining research engineer for St. Joseph Lead.**

# Chemical grout quickly stops high pressure water flow

The first opportunity to use AM-9 in a shaft was in Meramec's No. 1 shaft when a porous fractured dolomite was encountered. Cement grouting was tried, but was only partially effective, and injection rates were very low. Static pressure was 240 pounds per square inch, and the openings were so small that a hole only two feet from a grouted hole would flow 120 gallons per minute. Chemical grout was injected with ease, and did a quick job of closing the smallest openings. The training and experience gained on this small preliminary job were very helpful.

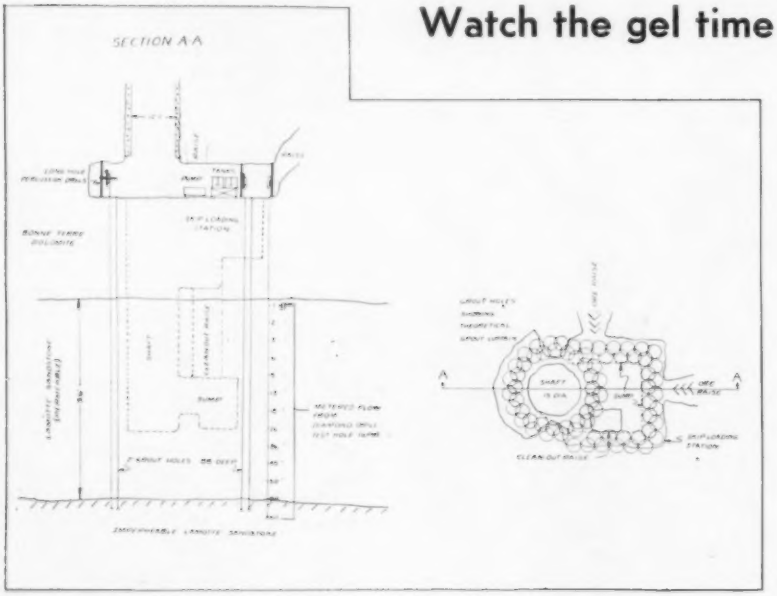



CHEMICAL GROUTING arrangement at Virburnum No. 28 shaft bottom. Note the 100 mesh screens on grout pump intake and independent cement grouting equipment on right. On top of the grout pump at right are sectionalized grout packers.

The No. 1 shaft, 22 feet in excavated diameter, subsequently penetrated 20 feet of permeable sandstone which was successfully sealed with AM-9, and then passed through 100 feet of impermeable sandstone which caused no difficulty.

Another major chemical grouting project was undertaken at the Viburnum No. 28 shaft. In this case, the task was more difficult as the shaft had to bottom in sandstone, a drift-sump had to be cut, and a short spill-rock raise driven to the loading pocket . . . all in water-bearing sandstone! Accordingly, it was necessary to surround the entire area with a double fence of grout holes, 88 feet deep. See diagram for details. The holes were spaced four feet apart and 13 feet from the shaft center on the outer-ring. The inner-ring holes were collared 11 feet from shaft center and spaced in between outer-ring holes. Fortunately, flow measurements and permeability tests showed that an impermeable layer was conveniently located below the shaft bottom. Grout holes could thus be bottomed in this layer, eliminating the necessity for providing a grouted "plug" to prevent flow up through the bottom. This fortuitous phenomenon has contributed to the success of every major chemical grouting job in the district.

Two Gardner-Denver 99's with one inch hexagonal sectional steel, and two inch tungsten carbide bits




## Watch the gel time carefully when using

A few characteristics of AM-9 grout deserve special emphasis. Its viscosity remains very close to that of water right up to gel time. Therefore, *provided* it contains no insoluble material, it can be pumped into any formation which water will penetrate. However, the usual AM-9 solution does contain minor amounts of insol, and it has been found essential to strain the grout through 50 or 100 mesh screens in order to inject a sufficient amount of chemical through each hole in the fine-grained Lamotte sandstone.

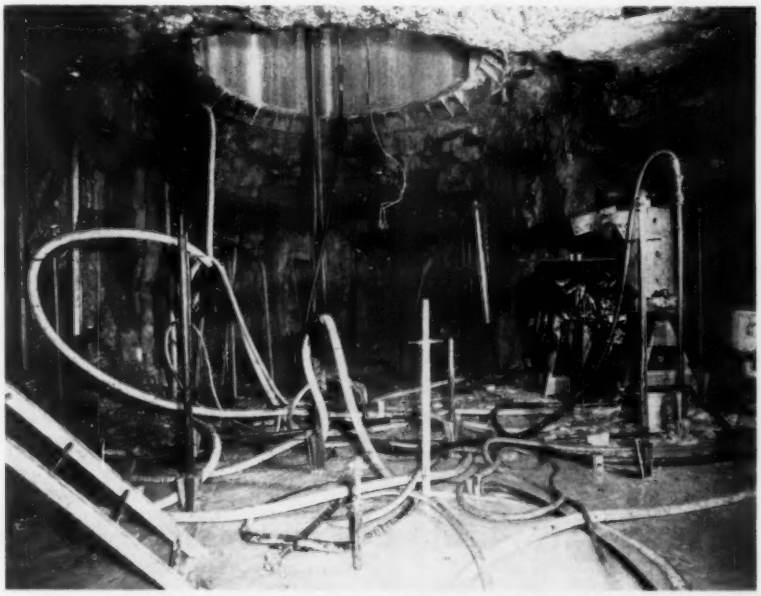
In order to use AM-9 with very short gel times, i.e., below five minutes, it is desirable, if not essential, to use a two-pump metering system for injection. Such equipment has been developed by American Cyana-

## from fractured dolomite and permeable sandstone

were used to drill the 88-foot grout holes. Alignment was carefully controlled with a Brunton clinometer. Expanding-rubber type grout packers were used. An interesting aspect of the job was the use of coupled packers 28 feet long. It was necessary to seat the packers at the dolomite-sandstone contact to prevent loss of chemical into the fractured dolomite which was to be grouted with cement. A 10 by 3 by 10 duplex grout pump was used with one inch high pressure Aeroquip hose (1,500 pounds per square inch). Grouting pressures occasionally reached 1,100, but usually were in the 400 pounds per square inch range.

The most recent use of chemical grouting was in Meramec Mining Company's No. 2 shaft. The diamond drill test hole was collared in the 1,065-foot pump station, and was flowing 200 gallons per minute after penetrating the first 15 feet of sandstone. Needless to say, such flows made the drilling of grout holes very difficult. All initial holes were drilled through grout packers and two inch gate valves. Drill steel had to be held in the hole with special tools while adding or taking out sectional rods. Flow up the hole in the drill steel was great enough to force cuttings into the machine, and wash all oil out of the drill, thus practically stopping the machines from rotating. This problem was solved by drilling down to the water with an orthodox bit, then changing to a bit with all water holes plugged. Even this did little to ease the discomfort caused by water to the personnel operating the machines. It was necessary to put two holes down at the same time to relieve the pressure on each. However, no more than two could be drilled at one time because of pumping capacity.

On all jobs there was a man in charge of each shift especially trained in handling chemical grout. Its higher cost, mode of application, and effectiveness certainly justify this added supervision.



GROUT HOLES are spaced around the periphery of Viburnum No. 28 shaft bottom as shown in this picture. The long hole drilling machine used to drill holes is set up in the right background. Circular shaft shows plainly at top.

## these chemical grouts and vary to meet underground conditions

mid, and is especially helpful in grouting behind linings or elsewhere when return flow into the mine opening is almost instantaneous.

Another type of chemical grout has been used successfully by St. Joe in a limited way. Its trade name is Terra Firma, and it is marketed by Intrusion-Prepakt Company. This material utilizes a byproduct of the wood pulp industry, and is very easy to handle, i.e., the dry powder is simply mixed with water. Gel time depends on the water-powder ratio. Terra Firma differs from AM-9 in that it contains considerable amounts of very fine insoluble material, and also in that its viscosity gradually increases from the moment it is mixed with water. Therefore, it is not as effective as AM-9 in very fine-grained sandstone, but has definite advantages in coarser grained material, or in penetrating fine fractures, and costs considerably less.

Terra Firma was used successfully where water was leaking through several small fractures into a conveyor drift at a skip pocket. Injections through ten 40-foot grout holes materially reduced the seepage. This material has also been used with some success by Meramec Mining to control seepage through the shaft lining and into the surface access tunnel for No. 1 shaft.

In conclusion, it is the hope of the authors that this article will stimulate a more scientific approach to a very serious problem; a problem that costs the mining industry large sums annually, and which is too often approached on a haphazard basis.

The authors wish to extend their appreciation to the St. Joseph Lead Company for permission to publish this article.

END

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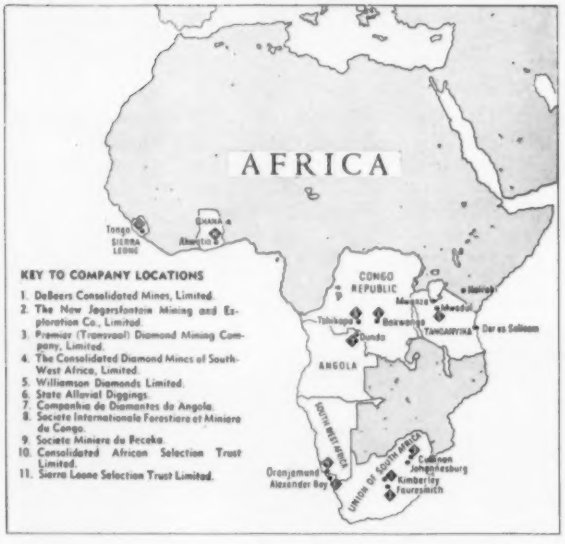
Kennedy, T. B., Research in Cement Grouting

Polatty, J. M., Investigations of Sand-Cement Grouts

Swiger, W. F., and Boyd, J. H., Design and construction of Grouting Cutoff—Rocky Reach Hydroelectric Power Project

Swift, R. A., and Karol, R. H., Effects of Flowing Water and Stratification on Grouting Efficiency

Ramos, John, and Hower, Wayne, Grouting of Deep Shafts and Underground Reservoirs




# How Diamonds

## Part II of III

**By A. F. Daily,** consulting mining engineer, 488 Fairbanks Avenue, Oakland, California. He has been a consultant for various exploration and operating gold dredging companies in Alaska, Canada, New Zealand, Colombia, Brazil, and Honduras. He recently completed an extensive tour of the principal diamond mines in Africa, and directed the first technically engineered prospecting in Brazil for diamonds in a river valley gravel deposit.

World production of diamonds rose to a record value of $265,000,000 in 1959 with a production of 26,300,000 metric carats. About 80 percent of these diamonds were of industrial quality with peak output of 28,000,000 carats in 1958 being made possible by the high output in the Lubilash district of what is now the Congo Republic.

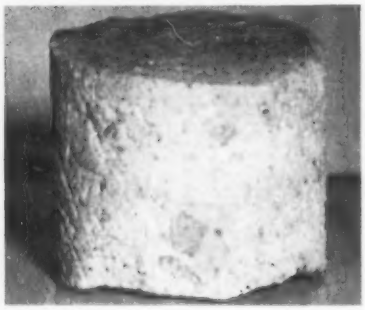
African diamond companies and their operations which were accurately described in part I of this series are as follows:

DeBeers Consolidated Mines Limited holds a commanding position in the industry from mining to final sales. The firm operates five pipe mines in the Union of South Africa, controls Consolidated Diamond Mines of South West Africa Limited, owns one-half of Williamson Diamonds Limited, has established and owns a controlling interest in the Diamond Corporation Limited and substantial interest in other companies of the Central Selling Organization, which wholesales about 87 percent of all diamonds mined in the world.

Consolidated Diamond Mines of South West Africa Limited (CDM) operates the world's largest gem diamond mine. This is an alluvial mine along the sea coast north of the Orange River mouth.

Société Internationale Forsetière et Minière du Congo (Forminiere) operates 55 small alluvial mines along the

## Kimberlite, a basic igneous breccia, is source of all diamonds



KIMBERLITE CORE 6 inches in diameter from Beceka. Note fragmental inclusions of country rock in this breccia.

Geologists generally agree that all diamonds were formed under suitable environmental conditions in the igneous matrix of the ultra-basic rock named kimberlite, defined as a highly serpentinized peridotite which, in South Africa and at Williamson is called dolerite. All diamonds found to date in a primary deposit are in kimberlite, but not all kimberlite contains diamonds. Typical associated minerals in diamondiferous kimberlite include diopside, pyrope garnet and ilmenite (all containing magnesium and chrome), calcite, zircon, olivine, chlorite, biotite, pyrite, and barite. Inclusions of country rock through which the magma ascended are commonly present in sizes up to 50 tons, so the rock is a breccia. At various locations the inclusions are granite. quartzite, sandstone, limestone, gabbro, etc.

Kimberlite deposits are typically in the shape of funnelform pipes of oval cross-section with a mushroom shaped top, but they also occur as dikes. Studies of the Williamson pipe indicate that it erupted above the surface as a low cone. The contact face between kimberlite and the country rock usually is very clean and well defined with little alteration of the wall rock. At the diamondiferous pipes discovered to date in Africa there was no significant topographic expression such as a dome or a depression except for koepkes or small hills at Kimberley.

As a result of weathering processes exposed kimberlite becomes saprolite; fine material washes away resulting in an eluvial concentration of diamonds and resistant minerals at the surface, and erosional processes produce diamondiferous alluvial formations. The depth and degree of weathering depend on the character of the kimberlite, climatic conditions, time and other factors, and intense weathering has been observed to a depth of 40 meters. In the South African pipes the upper zone weathered to a yellowish color hence the name "yellow ground" applied by the miners, and as the degree of weathering decreased with depth the color became bluish and the formation was called "blue ground."

Use of these terms persists though the unweathered kimberlite in South Africa is grayish black, in Congo Republic is dull reddish brown to gray black, in Angola red brown, and at Williamson greenish black to black.

# Are Found and Mined in Africa

Kasai and parallel rivers in the southern part of the Congo Republic.

Williamson Diamonds Limited, named after the late Canadian geologist Dr. John Williamson who found a diamondiferous kimberlite pipe at Mwadui, Tanganyika, is the latest major diamond discovery in Africa.

Societe Minière du Bécéka (Bécéka) recovers diamonds from alluvial deposits near the top of five kimberlite pipes near Bakwanga, Congo Republic. This is the world's largest diamond producer—50,000 carats per day of which 97 percent are industrials with 90 percent of these crushing bort.

Consolidated African Trust Limited (CAST) recovers small alluvial diamonds—30 per carat—from gravel beds in Ghana.

Companhia Diamantes de Angola (DIAMANG) operates 46 field washing plants in Angola to recover alluvial diamonds in northern Angola. About 60 percent of the stones are of gem quality.

Sierra Leone Selection Trust Limited (SLST) recovers large alluvial gem diamonds from many alluvial deposits in eastern Sierra Leone. Kimberlite pipes have been found recently.

The great increase in production to meet the world's growing demand has been met by the principal producers by increase in scale of operation and improvements in efficiency of recovery by methods developed by research.

Part III will summarize the many recovery methods at all major South African plants.

### Congo Republic Mines Now Closed

All mining halted in Kasai Province of Congo Republic early in September when National Army moved in to suppress tribal warfare between the Lulua and Baluba tribes.

Normal mining operations had been resumed on July 4th after independence celebrations were over.

No damage to mines and equipment has been reported. The native labor remained orderly and faithful throughout.

Production from Bécéka for first six months of year was an all time high of 9,266,000 carats. Stocks of stones outside the Congo are ample to meet demand.

## but alluvial deposits yield 85 percent of total mined

The "yellow ground" is light colored—greenish, pinkish, and dark in the Congo; light to pinkish at Williamson. Diamonds may be dispersed irregularly or rather regularly in the kimberlite. In general the tenor decreases as the depth increases.

As of 1959 about 15 percent of the diamonds produced in the world were mined from kimberlite and 85 percent from alluvial deposits. In South Africa some mining has been done in Kimberlite dikes.

By erosional processes a kimberlite pipe may gradually be destroyed to a point at which no traces are discernible, and during this long period it may be disturbed by tectonic movements or a remnant may be covered by sedimentary or volcanic deposits. A normal sequence of events results in formation of diamondiferous placer deposits which in turn may be covered by barren material, become indurated to any degree. subjected to warping, tilting, faulting, or marine or wind action, and subsequent erosion in one or more additional stages of deposition or reconcentration. The source and history of several deposits is complex and very obscure and may never be satisfactorily determined.

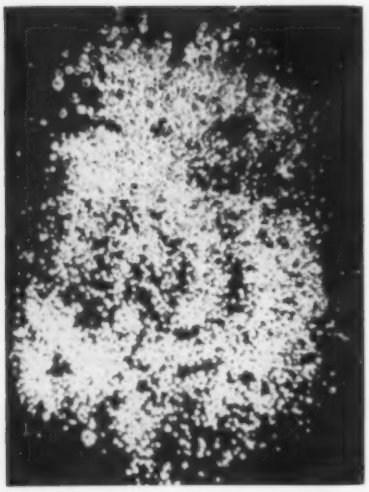
Good examples are the marine terrace deposits along the western coast of South and South West Africa and those on hilltops in the Diamantina district of Minas Gerais, Brazil. In Ghana the proximate source of the diamonds is several steeply dipping beds of Pre-cambrian graywacke from which they have been released by relatively recent erosional processes, and in some deposits in Brazil is beds of Pre-cambrian conglomerate or other rock. Thus, diamondiferous placers may be primary and derived directly from surviving remnants of pipes as at Bakwanga, or secondary or tertiary following a simple or complex series of events. Alluvial deposits are found in remnants on hillsides, as terrace deposits, and in stream beds. The distribution of diamonds ranges from rather uniform to concentrations in "paystreaks" or a braided channel pattern, and may be in well or poorly defined vertical or horizontal patterns.

As used herein in relation to diamondiferous formations a satellite is defined as any mineral or rock having a specific gravity greater than 2.95. The distinction is based on specific gravity because one or more methods of gravity separation are employed in all concentrating plants, and 2.95 is selected because it represents a fair average point of separation. The specific gravity of diamonds is close to 3.50.

The quantity or percentage of satellites present in any deposit depends on the characteristics of the deposit and, in alluvial deposits, on the composition of source formations that have been eroded by the present or earlier stream system. The percentage in kimberlite ranges from 0.3 to 4.0 and in alluvials in Africa from 0.1 to 3.5; in Brazil upwards of 25 percent has been observed. The principal mineral satellites occurring in kimberlite have been named above, but the specific gravities of the rock itself as well as included breccia fragments are variable and a portion of them reports as satellites.

The percentage of satellites limits the ratio of concentration possible by gravity methods, and their characteristics influence the application of subsequent methods of concentration and may limit the degree attainable by known methods.

**Turn page for stripping and mining details ▶**



GEM DIAMONDS, 4,000 carats of them from one day's production at CDM.

## Each mine produces distinct type diamond

The diamonds present in each deposit have distinct average characteristic qualities, i.e., percentage of gem and industrial grades, and a characteristic size range or sieve analysis. Also, those from each deposit exhibit typical crystal forms, regular octahedron, hexoctahedron or other well developed shape, misshaped, etc., and a typical variety of colors and shades which may apply to limited size ranges. Expert graders and valuers can immediately identify the source of any parcel of stones from one property. Many obviously broken stones have been found in the alluvial deposits at Bakwanga, leading to much speculation about the reason. Mechanical breakage during erosional processes did not seem likely as practically no broken diamonds were found in other deposits where conditions had certainly been more severe. Following discovery and some mining of the kimberlite which is the source of diamonds in the alluvials, it was found that it contained broken diamonds in the same percentage, thus settling the question of origin but not why stones in the kimberlite are broken.

The distribution of diamond sizes in a deposit is important because of the great difference in unit value between large and small stones, and the economics and limitations of recovery processes. At the majority of properties the selected lower size limit for

## Prospecting cost is often 10 percent of total operating costs with sampling to mining ratios as high as 1 to 500

At all of the principal properties the objective of prospecting is valuation within plus or minus-5-percent by blocks containing a volume that can be mined within a period of about a month. This exacting procedure is followed to enable negotiation of realizable delivery contracts with the Central Selling Organization, planning of operations to assure meeting monthly commitments, and adjustment of mining and production to compensate for unforeseen contingencies causing significant under-runs or over-runs. The diamonds recovered from prospecting are accumulated for relatively small areas and each lot valued by an expert to establish its average value per carat for valuation purposes. The cost of prospecting may amount to as much as 10 percent of total operating expense.

The five underground kimberlite mines now active are: Bultfontein, Wesselton, and Dutoitspan at Kimberley, Jagersfontein at Fauresmith, and Premier at Cullinan, all operated by De Beers. In these mines prospecting and development are conducted concurrently, usually for successive "lifts" downward of 600 feet between haulage levels.

All of the kimberlite mined in development is treated as batch samples in special sections of the concentrator and recovery plants or in separate plants. Thus a basic valuation by blocks is obtained which is extended for smaller volumes as development proceeds. The total volume of samples for a lift is thousands of tons, and the time required for prospecting and development work for a lift is about five years.

Kimberlite was discovered at Williamson, Bakwanga, and Diamang by digging open prospect holes through overburden of various thicknesses, about 35 meters at Bakwanga. At these three properties valuation prospecting has been done by digging and by drilling holes to a maximum depth of about 60 meters, and the effective depth by this method has been limited by the depth of overburden.

At Williamson small open holes were first used; then, after removal of 6 to 10 feet of black cotton soil overburden, the top of kimberlite and the adjacent thin alluvial deposits were prospected by excavating trenches about 3 feet wide by 50 feet long, laid out on a grid pattern on lines about 200 feet apart, in increments of one foot to maximum depths of about 10 feet. Within the pipe area 5 foot square shafts spaced not over 500 feet apart were then sunk to depths of about 50 feet. The samples were crushed if necessary and concentrated in the field in a portable diamond pan and jig unit. Later, nine prospect shafts were sunk to a depth of 200 feet, and a shaft is being sunk in country rock to start underground prospecting.

PROSPECTING TRENCH 1.0 meter wide in gravel below beach sand.

At Bakwanga the tops of the kimberlite pipes were prospected by digging holes 1.13 meters in diameter (area 1.00 square meters) to a maximum depth of about 60 meters through 10 to 40 meters of overburden.

The Benoto drill has been used extensively to sink both 90 and 60 millimeter diameter holes to a depth of 60 meters. These are arranged in closely spaced clusters of two to four holes unless the unit value is high, say more than 5.0 carats per cubic meter. At the Diamang property open holes 1.60 meters in diameter (area about 2.00 square meters) have been dug by hand to depths of about 40 meters. At both these properties the weathered kimberlite is concentrated

## with jewels made from cuttables which show flaws as mined

recovery is about 1.0 millimeter, but there are notable exceptions; 1.91 at CDM in South West Africa where the average unit weight recovered is 0.86 carat, 0.59 at Kimberley and Premier, and 0.5 at CAST in Ghana where the average size is about 30 stones per carat. An international metric carat is a weight of 200 milligrams.

On the criteria of quality rough diamonds are classified into two groups, gem and industrial, and the latter may be subdivided into industrial, bort, and crushing bort.

A gem quality rough diamond is one of which any portion can be utilized for cutting and polishing, producing a stone(s) usable in jewelry; the trade synonym is cuttable. Cuttables, therefore, include many stones with flaws, imperfections, inclusions, or of poor shape or color, and the distinction between gem and industrial is not clearly defined and may depend on market demand. The smallest size of cuttable diamond is about 1.5 mm square mesh; all other diamonds are of industrial quality.

The subdivision industrial (as used herein) includues diamonds of gem size but not of a quality suitable for use as gems because of shape, mechanical imperfections, inclusions, or undesirable color. Bort comprises rough diamonds unsuitable for use as gems, or as industrials as defined above, because of small size, irregular shape, imperfections, or occurrence in finely crystalline aggregates, and includes rejects from cutting of gem diamonds. Crushing bort is a distinctive type of rough diamond having a radial or confused crystal structure, without distinct cleavage planes, suitable only for crushing into grit, powder, or dust. About 50 percent of world production by weight is crushing bort of which about 98 percent is mined at the Beceka property at Bakwanga, Congo Republic. Synthetic diamonds produced to date are generally competitive with crushing bort.

There are two other types of industrial diamonds, carbonato and ballas, which are found principally in Brazil and rarely in Africa.

STRIPPING SANDY OVERBURDEN by ground sluicing at Cia de Diamantes de Angola. Note men loosening bank.

PROSPECTING FIELD PLANT in Ghana using multi-deck rocker screens and Joplin jigs for recovering alluvial diamonds.

at a field plant by washing, screening and jigging that will be described below under alluvial prospecting.

The procedures described above are used for valuation prospecting. Some geophysical work has been done, primarily to attempt to define the perimeter of pipes covered by overburden, which produced useful information in one or two places.

For prospecting alluvial deposits the procedure used at all properties except CDM for obtaining the samples is digging open holes by hand. The standard sizes adopted are 1.60 meters diameter by Diamang, 1.13 meters diameter by Forminiere, and 2 by 5 feet by CAST and SLST. The final pattern for valuation generally is square grid spacings ranging from 30 to 40 meters to 200 feet centers. In general the lower the grade, the larger the hole and the closer the spacing. Comparative data on average unit diamond contents are given in Table No. 1 in the first section of this series.

Overburden is discarded, the gravel and top of bedrock removed in increments, and the samples taken to a field site where water is available. Each sample is washed and screened in a wood-frame multi-deck rocker screen that is oscillated by hand. An oversize and an undersize fraction is rejected and three or four intermediate size fractions are concentrated separately in hand operated Joplin type jigs. The light fraction on top in each jig tray is carefully skimmed off with a scoop and the concentrate hand picked several times for diamonds. Records of volume, weight, composition, diamond content, etc., are made and the components of the satellites may be determined. In Ghana, where many of the diamonds are very small, 1.0 by 0.5 millimeters, and the percentage of satellites often is relatively high, the diamond picking is done by trained teams of girls. From these data, surveys, and the unit value of diamonds, the block valuations are calculated. The prospecting ratio in gravel at these properties ranges from 1 : 900 to 1 : 4,000; a comparable ratio for prospecting for gold, say one 6-inch nominal diameter hole per acre, is 1 : 130,000.

At CDM the ancient beach deposits are prospected by trenches that cross-cut the deposits at intervals of 500 to 600 meters. The loose sand overburden is removed with powered equipment to expose a strip about 5 meters wide just above the top of gravel. The diamondiferous gravel deposit, that may be unconsolidated to almost cemented, is sampled by hand digging a trench, 1.0 meter wide which may be up to 3.0 kilometers in length. A section 1.00 meter square by 5.00 meters long constitutes one sample. The prospecting ratio, therefore, is 1 : 500 to 1 : 600, and the relatively large volume of overburden stripped for prospecting usually has to be rehandled later.

**Continued overleaf**

## Underground mines use block caving; bucket wheel excavators

In the five DeBeers mines named above the chambering system of mining was introduced in about 1890 and has been employed with little change until very recently. In this system the main hoisting shaft is sunk in country rock about 1,000 feet from the perimeter line of the pipe on the surface, and development and mining proceeds in successive increments of about 600 feet between main haulage levels. Development is started by deepening the main hoisting shaft to the selected level. The cross-sectional shape of the pipe at that point then is determined by excavating a drift that passes close to the center of the pipe and extends into country rock on the far side, followed by excavation of other drifts in a grid pattern to accurately define the boundaries. This procedure is important as it has been discovered that, at depth, the size and particularly the shape of pipe changes, generally from oval toward dumbbell shape. From the results of this work the position of the new perimeter haulage drift is selected, in country rock about 100 feet outside of the pipe. A pattern of drifts also is excavated at intermediate levels about 200 feet apart to provide, among other things, data for selection of locations for sub-level shafts about 100 feet outside of the pipe and ore passes to the main haulage level.

For mining by the chambering system, levels are developed at 40-foot intervals with parallel drifts 12 feet wide with pillars 10 feet wide between, and loading cross cuts at right angles to the chamber drifts at 22.5-foot centers. The chamber on each level is below the pillar on the level above it. Mining is started by inclined top slicing at the far end of each chamber drift, the ore is removed to a height of 40 feet, and the pillar above caves into the chamber. The faces are advanced en echelon so that each is at least three cuts ahead of the one below it, to prevent lower workings from weakening those above. Broken ore is hand loaded into cars and trammed to the nearest ore pass in the country rock, in which it drops through a control gate into a car on the main haulage level, which in turn is moved to the hoisting shaft pocket by attaching to the endless cable.

Experimental block caving, started in the Bultfontein mine in 1953, proved successful and economical, and has now superseded chambering in that and the Jagersfontein mine. The change in systems is in progress in the Dutoitspan and Premier mines, but chambering is being continued in the Wesselton because of the irregular shape of the pipe.

Development for block caving also proceeds in lifts of about 600 feet. Following determination of the position and shape of the pipe, a 10½ foot square perimeter main haulage drift is excavated in country rock. Scraper drifts extending across the pipe at 47 foot centers, with draw point raises 22.5 feet apart on each side, in staggered positions, are excavated on a level about 12 feet above the floor of the main haulage level. The scraper hoist pockets are located outside of the haulage level drift, at scraper level elevation, and are connected with a small perimeter access drift. The scraper drifts are lined with concrete, 6 feet square inside; the draw points are also concreted, and a strong

## Alluvial deposits vary widely in size and overburden depth

At the alluvial properties in Angola and the Tshikapa district in Congo Republic the deposits of commercial tenor are widely scattered and independent operations are conducted at about 93 locations, each having a field washing and concentrating plant. The thickness of diamondiferous gravel seldom exceeds 2 meters but the eolian overburden deposit may be up to 40 meters in thickness in Angola, though the overall ratio for the mines is 4 to 1.

Overburden up to 3 or 4 meters in thickness usually is removed by hand and dumped to one side or into a worked out cut. At a number of the mines deeper overburden, up to 40 meters in thickness, is removed by ground sluicing. For this purpose water is obtained by gravity flow or pumped into a ditch located above the area to be stripped, then distributed through a system of lateral channels. A straight face is started by digging a ditch in the direction of maximum slope, which the water rapidly deepens to the top of gravel. The material along one side of the channel is loosened by men working along the face and, as the face advances, the water channel is continuously forced against the toe of slope by constructing a small dike on the other side. This procedure results in a series of low parallel ridges on top of gravel which may be removed by hand or with power shovel and truck. Hydraulic stripping with IntelliGiant nozzle units was initiated in Angola in 1959. At locations where stripping by hand or water is not feasible, Caterpillar bulldozers, Bucyrus-Erie shovels or draglines, and Euclid trucks are used. Of the 8,400,000 cubic meters of overburden removed in 1957 by Diamang, approximately one-third was handled by each of the three methods—hand, ground sluicing, and mechanical.

At these two properties the small deposits are mined by hand and the gravel transported in wheelbarrows or in hand-trammed side-dump cocopan cars to the portable field washing plant. At larger deposits endless cable haulage systems up to 3 kilometers in length are installed for moving the hand-loaded cocopan cars to semi-permanent field plants. At other mines small power shovels and trucks are being used. The top of bedrock always is thoroughly cleaned by hand.

At the seven alluvial mines operated by Forminière at Bakwanga and the nine by CAST in Ghana the ratio of overburden to gravel probably averages about 1.5 to 1.0, and approximately 95 percent of the material is excavated with mechanical equipment. At Bakwanga combinations of LeTourneau dozers, Tournapuls, Bucyrus-Erie shovels and LeTourneau trucks are used, and also a Lubeck Roto-pelle bucket wheel digger having a rated capacity of 200 cubic meters per hour which discharges overburden into trucks. CAST uses Ruston-Bucyrus 1.5 cubic yard shovels and Foden 7.5 cubic yard trucks equipped with Gardner Diesel engines as standard units.

At CDM the diamondiferous gravel occurs in continuous marine terrace deposits extending northward from the mouth of the Orange River for an unknown distance, usually within 3.0 kilometers of the present strand line. The average thickness of gravel is about 3.0 meters, the loose eolian overburden may be up to 13.0 meters in thickness, and the average stripping ratio is about 2.65 to 1.0. The scale of operation is tremendous, about 9,000,000 cubic meters of over-

## strip unconsolidated overburden from top of pipes

structural steel and concrete loading chute and gate is installed at the discharge point of each scraper drift over the main haulage level. Caving is started by completely undercutting the ore body on a sub-level 19 to 29 feet above the floor of the scraper drift.

An underground belt conveyor system is being completed to connect the three mines at Kimberley to one main hoisting shaft, and primary crushing to minus-12-inches is done in underground stations. Remarkable improvements in efficiency and reductions of cost resulting from adoption of block caving are reported by Mr. W. S. Gallagher, general manager of DeBeers.

At the Williamson mine the relatively thin black cotton soil overburden is removed during the dry season with power shovels and trucks but, as it has been found to be diamondiferous in places, much of it is now treated as ore. The very thin alluvial mantle around the perimeter of the pipe and the weathered kimberlite is dug with power shovels or a 6 cubic yard dragline, and hauled in Euclid dump trucks to one of several loading stations where oversize is put through a primary crusher. The minus-6-inch ore is transported to the central concentrator storage bins on a 24-inch wide belt conveyor about 9,000 feet long which is set on top of the ground. Though weathered, the kimberlite is hard enough to require drilling and blasting. Ruston-Bucyrus 27RT drills are used for drilling 6-inch diameter holes, and Dynagel or 60 percent common gelignite explosive for blasting.

At the Bakwanga mine overburden was removed from the top of the first pipe with power shovels and trucks. The red sandy overburden formation is being stripped from the top of the large pipe, named the Disele mine, with a Lubeck rotating bucket line excavator which has a rated capacity of 400 cubic meters per hour. The average rate of excavation is about 1,600,000 cubic meters per year. The area is excavated in panels about 30 meters in width and up to 1,500 meters in length, in one or more steps or benches, depending on the depth of the overburden. The material is discharged from the excavator conveyor into a traveling hopper on a three-section reversible unit, belt conveyor set on the surface parallel to the line of the cut, from which it is transferred to a belt conveyor system about 3 kilometers in length terminating on the tailing pile, where it is distributed with a large, portable, stacking unit. The curved ridges of overburden that are left by the bucket line digger will be removed with power shovels or draglines and trucks. A great deal of care is exercised to avoid removal of even one centimeter of the underlying kimberlite which contains a concentration of diamonds at the surface.

At this property the weathered kimberlite mined to date is sufficiently decomposed so that it can be dug by a power shovel without drilling and blasting. In the pipe where mining operations were commenced in 1959 the ore is dug with power shovels, loaded into Euclid trucks and dumped into elevated bins which discharge onto a cable belt conveyor 1,450 meters in length that terminates at the receiving bins in the new central concentrator plant.

## as local conditions dictate hand or mechanized mining

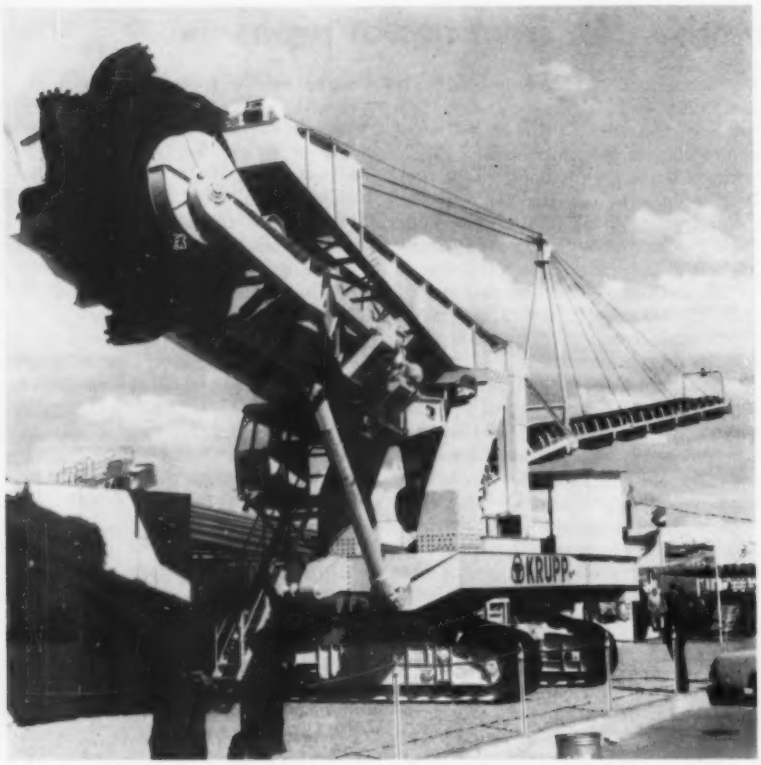
burden removed and 3,300,000 cubic meters of gravel mined per year. The standard mining plan consists of removal of overburden to expose the top of gravel in a strip 60 to 100 meters wide that cross cuts the ancient beach line deposit which may be from 100 to more than 500 meters wide, followed by mining the gravel. An initial cut is excavated in the sand with Tournapuls and Caterpillar scrapers, but the major portion of the stripping is done with bucket wheel excavators in combination with one to four portable belt conveyor units arranged in series which convey the sand to the dump area. Both types of units are electric powered and mounted on crawler trucks, many of them on Sherman tank chassis obtained from war surplus. The company has about 18 bucket wheel units of various sizes and 41 stacker belt conveyors. If an adjoining area has been mined the sand is dumped into the worked-out area, and otherwise is elevated and dumped on the surface of the ground. Caterpillar dozers and Ruston-Bucyrus draglines are used as auxiliary equipment.

Several procedures or combinations thereof are employed for mining the gravel. Ruston-Bucyrus Diesel or electric shovels are used for loading Tournarockers which transport the material to the field washing and screening plant. Another procedure consists of laying a 24-inch gauge track on the surface of gravel along one side of the cut, excavating with shovels and loading 1.0 meter capacity cocopan cars that are assembled in trains of 10 to 16 cars which are moved with Diesel or electric locomotives to the field washing plant. The track alongside the cut is relocated upon completion of excavation of a strip by the shovel. A third procedure consists of installation, on the surface along one side of the area to be mined, of a belt conveyor which carries the gravel excavated by shovel to a truck loading bin installed at one end of the cut.

In many places the gravel contains boulders which are pushed or dozed to one side and left in the cut. The extremely irregular, hard, bedrock is thoroughly cleaned by hand, 2,600 African employees being assigned to this work who are paid a bonus for diamonds which they find. Approximately 20 percent of production is obtained from the bedrock horizon.

Thirteen field washing and screening plants were being operated by CDM in 1959. Two standard designs are used, the larger with Symons vibrating screens, rated capacity 115 cubic meters per hour, and the smaller with Gyrex screens, rated capacity 75 per hour. In these plants the gravel is thoroughly screened dry or washed with sea water and screened to produce an intermediate size fraction, 25.0 by 2.74 millimeters to 18.0 by 1.91 millimeter square mesh openings depending on location. This size fraction has an average volume of 16 percent of head feed and is loaded into 3.5 cubic meter capacity narrow gauge cocopan cars. The loaded cars are assembled in trains of 24 cars and hauled by Diesel or electric locomotive to the central concentrator plant; a distance of up to 60 kilometers in 1959.

The combined oversize and undersize fractions are transported by inclined belt conveyor to large tailing piles, some of which extend into the sea where material dumped beyond the storm strand line is washed away continuously. END




BUCKETWHEEL EXCAVATOR by Krupp was displayed in the outside exhibit area. This machine has a capacity of up to 470 cubic yards per hour.

ROTARY DRILL was one of several mobile rigs displayed by Le Roi.

# Giant Open-Pit Equipment Dominates

The 1960 American Mining Congress show in Las Vegas, Nevada, last month was the largest and best attended exposition ever presented to the world mining industry. Some 223 companies displayed their diverse products and services at the Las Vegas Convention Center October 10 through 13, and over 8,000 visitors flocked to the attractive exhibits.

New equipment was the theme of the convention, and 53 new products were introduced to the mining public by leading manufacturers. Larger trucks with greater horsepower, and huge bucket-wheel excavators dominated the open pit equipment. Faster and more versatile drilling machines lead the underground equipment. On exhibit was everything from new crushers to magnetometers; the world's largest end-dump truck to a revolutionary new defluidizer. There were items of interest for everyone concerned with exploration, mining, smelting, transportation or safety.

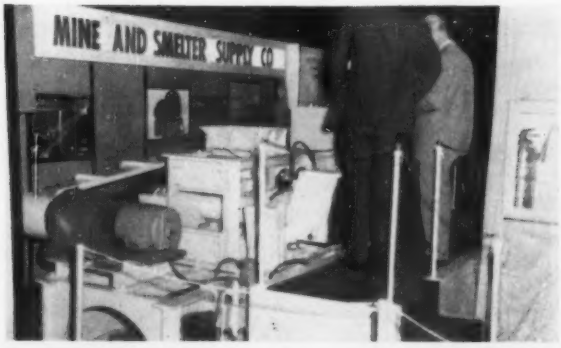
In the five meeting rooms adjoining the huge exhibition hall daily sessions were held and papers read on all phases of mining. Addresses were given by several United States Senators and Representatives, as well as other government and state officials.

Business executives also keynoted several of the sessions. Dr. Elgin Groseclose, financial consultant and internationalist of Washington, D. C., stated that the outlook for the gold and silver mining industries is good, and the demand for both far exceeds the supply. Mr. Simon D. Strauss, Vice President of American Smelting and Refining Company, speaking on the state of the copper, lead and zinc industries, emphasized that there is a more potential profit in research for new uses and in promotion of markets than can be found in lobbying for government aid in Washington. Mr. William B. Murray, executive assistant to the president, Atomics International Division, North American Aviation, Inc. predicted skyrocketing increases for future world energy requirements, and declared that by the year 2000, twenty to thirty percent of the United States electrical generating capacity will come from nuclear sources.

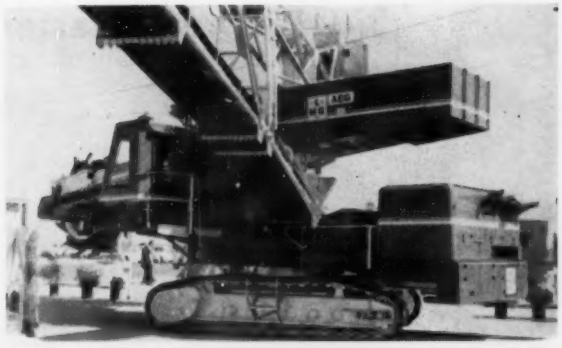
Over 150 technical papers were read during the four days of the convention. These ranged from the mining of huge iron ore bodies in Sweden to the mill operations of the El Salvador mine in Chile. Other important papers included subjects on industrial engineering, dust control, large borehole drilling, equipment maintenance, geology, plant automation and blasting. Most papers were accompanied by attractive slides or motion pictures.

## Exploration

Mr. E. E. Thurlow, Chief Mining Geologist for the Northern Pacific Railway Company, presented a paper on the geologic reconnaissance of large areas leading to economic appraisal. Mr. Thurlow discussed the eight steps his company takes in evaluating a certain area including aerial photography, geophysical methods, geochemical prospecting and physical exploration. Arriving at unit




NEW VERSATILE high speed crusher by Mine & Smelter Supply has double acting jaws that easily handle sticky ores.



LMG BUCKETWHEEL, made in West Germany, is now being sold in the United States and Canada by Link Belt Company.

HOUGH 120 PAYDOZER now has dozer attachment interchangeable with loader attachment of H-120 Payloader.

EUCLID exhibit was dominated by the new single drive axle, rear dump, 40 ton truck delivering 432 net hp.

# Las Vegas Machinery Exposition

cost data for any particular phase of this type program is difficult but the cost per square mile for aerial photographs and photogeologic interpretation is known to average $8.20. The field cost for geochemical prospecting an 83 sq. mile block was $13.48.

Dr. John L. Mero, Research Engineer, Institute of Marine Resources, University of California, Berkeley, presented an extremely interesting paper on the mineral resources of the ocean floor. Estimates of tonnages of economically mineable manganese nodules on the deep-sea floor range into the hundreds of billions of tons. These deposits are locally concentrated to over 150,000 tons of modules per square mile of sea floor. Analysis shows up to 50 percent manganese, 2.0 percent cobalt, 1.6 percent nickel, and 1.6 percent copper. Some nodules have assayed over 90 percent manganese and one nodule recovered off Africa weighed 300 pounds. The estimated production costs for deep sea mining of the ocean floor range from $4.00 per ton in 1,000 feet of water to $20.00 per ton in 5,000 feet of water.

Dr. Philip W. Guild, Chief, Base & Ferrous Metals Branch, U. S. Geological Survey, explained the development and future use of metallogenic maps now being compiled by the U. S. Geological Survey. These maps show the locations of all deposits and individual metals and non-metallic minerals in the continental United States at a scale of 1:2,500,000.

### Open Pit Mining

New blasting developments and blasting practices led the open pit papers. Mr. Harlan J. Poel, Manager, Technical Service Section, E. I. duPont de Nemours & Co., Inc. discussed the use of low energy detonating cord in low noise level trunk lines. This new cord was developed to reduce annoying noise and vibration resulting from blasting adjacent to residential or other populated areas.

The paper by Mr. Donald M. Stromquist, technical representative, U. S. Steel Corporation, explained the great ingenuity displayed by mining companies in devising more economical methods of mixing and handling ammonium nitrate-fuel oil mixtures in open pit operations.

Mr. Emery C. Olsen, Supervisor of Mine Inspection, U. S. Steel Corporation, presented a 16 mm color movie on the blasting practices and safety precautions taken in the open pit mining operations of the Columbia-Geneva Steel Division.

Another of the more interesting papers was given by Mr. Adolph Soderberg, Consulting Mining Engineer, and Mr. D. O. Rausch, Staff Engineer with the Kennecott Copper Corporation. Mr. Soderberg discussed the scientific techniques in control of open pit slopes. He showed spectacular photos of rock slides in the Bingham Canyon and Liberty pits of Kennecott, and explained the intricate test work that is now being undertaken in the Kimberly pit to study rock stresses that ultimately cause dangerous rock slides.

**Continued overleaf**

# Big new trucks, faster shovels, and more efficient drills

60-TON HAULPAK truck, feature of LeTourneau-Westinghouse, is powered by a 550 hp Cummins Diesel engine.

NEW JR-300 jack drill by Ingersoll-Rand that offers exceptional performance is admired by visitors.

VERSATILE new Gardner-Denver drill can be used as sinker, stoper or air leg.

DEFLUIDIZER by Mine & Smelter Supply dewaters by centrifugal force.

IMPROVED model 24 rocker shovel loader by Eimco offers many new features.

### Underground Mining

Dust control, mine fire fighting, and drilling were the principal topics of the underground technical sessions. Mr. Frank J. Lard of The Anaconda Company explained how dust control in underground mining operations necessitates a thorough knowledge of ventilation, rock wetability and dust capture, transport and retention characteristics. Mr. Howard L. Hartman, Head, Department of Mining, Pennsylvania State University, discussed the technical aspects of mine dust control. He stated that dust control underground had succeeded locally but failed generally. The reason for this situation is that mine dust control has failed to obtain recogniton or practice as a process of mine-air conditioning and one phase of an atmospheric-environmental control program.

A new technique for fighting small inaccessible underground mine fires was explained by Mr. Bernard W. Carey, Assistant Superintendent, Pickands Mather & Company. This new technique utilizes a high expansion light weight foam. This foam is moved along by the ventilating currents in a continuous plug. When it reaches the fire and providing it contains the proper amount of moisture, it tends to quench the flames by excluding air and diluting the oxygen by the formation of water vapor.

Mr. J. H. Dewey, Drilling Research Engineer, International Nickel Company of Canada, Ltd. discussed underground drilling practices at INCO and the broad developments that he foresees in this field.

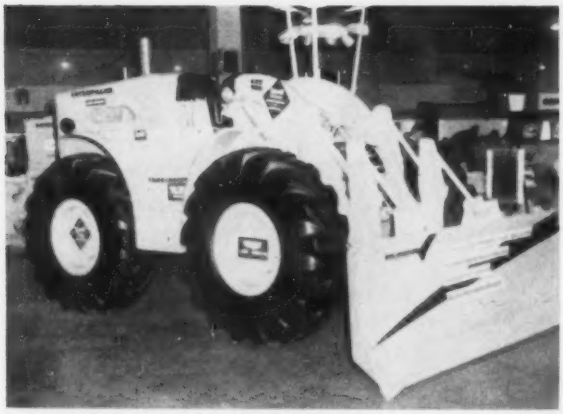
Large borehole drilling was the subject of the interesting paper presented by Mr. Eugene Mauck, Vice President of the Freeman Coal Mining Corporation. Several large diameter holes were drilled to depths up to 698 feet through various sedimentary formations in West Virginia. Work started with a 13-inch churn drill hole which was later reamed to 76 inches inside diameter. Total cost of such a hole to 698 feet deep was only $104.50 a foot.

The conversion of drum hoisting to the Koepe friction-type system at a Michigan iron mine was described by J. R. Gronseth of Inland Steel. The change was made when main shaft hoists of the Bristol mine reached their limit at the 1650 level and it was necessary to sink to the 1900 level. The converted system reaches the new depth with 35 percent greater capacity, and by changing the type rope could reach another 500 feet.

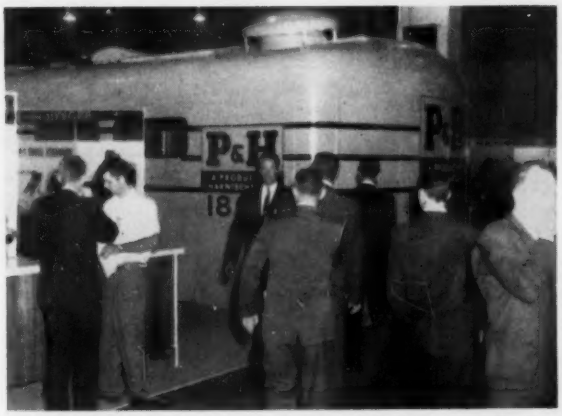
### Ore Treatment

Iron making by the Dwight-Lloyd McWane Process was explained by Mr. Robert C. McDowell, President of The McDowell Company. While the Dwight-Lloyd McWane process is well known in the mining and metallurgical industries, Mr. McDowell dis-

## for mining; metallurgists see new centrifugal defluidizer

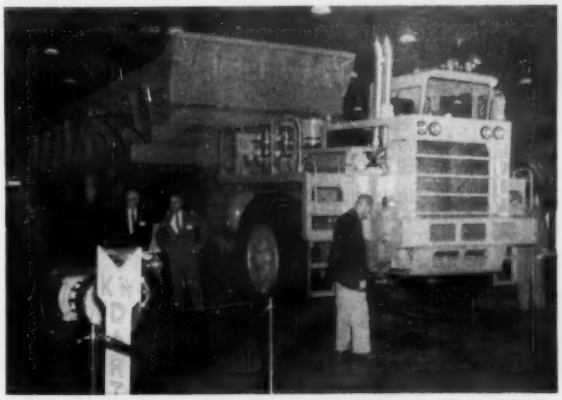


CATERPILLAR introduced its new 140 hp Traxcavator displayed with a light-duty Balderson dozer.




HARNISCHFEGER had an ingenious movie in the full size cab of a Model 1800 P&H mining shovel.

ESCO BOOTH was typical of many attractive displays. Some 223 manufacturers exhibited products at the show.



HUGE DART 95-ton, 700 horsepower, tractor-trailer combination rear dump was one of the largest vehicles.

cussed the evolution of the idea of altering metallurgical apparatus in order to conform to specifications of basic raw materials, rather than the heretofore practiced technique of altering raw materials in order to conform to specified operations of the metallurgical apparatus.

Mr. J. Gordon Craig, Mill Superintendent, Hecla Mining Company, showed how his company built the 500 tpd Lucky Friday mill in a short time at a cost of less than $1,000 per ton day.

Instrumentation and automation of plant operations was the subject of the paper given by Mr. R. G. Patterson, Production Manager for the California Portland Cement Company. Instrumentation and automation economically improve cement plant processes through an extension of the senses of the operator, and a reduction in the time lag between process evaluation and adjustment. It also relieves the operator of routine adjustments, making available more time for critical evaluation of long range process changes which may lie beyond present day control systems.

Instrumentation for process control in milling of copper-molybdenum and potash ores was the paper by G. E. Atwood and J. P. McCarty of Duval Sulphur and Potash Co. Metallurgical performance at Duval's plants is maintained at high level with minimum attendance. Savings in operating labor and improved metallurgy add up to important operating economies. END

**How close were you to winning a Mining World diamond?**

There were exactly 12,025 diamonds in the fishbowl in MINING WORLD's diamond-guessing contest at the Mining Show. The happy winners in each day's contest were:

*Monday:* Mrs. Robert G. Vizeeland, 1528 East McLellan Blvd., Phoenix, Arizona. She guessed 12,260.

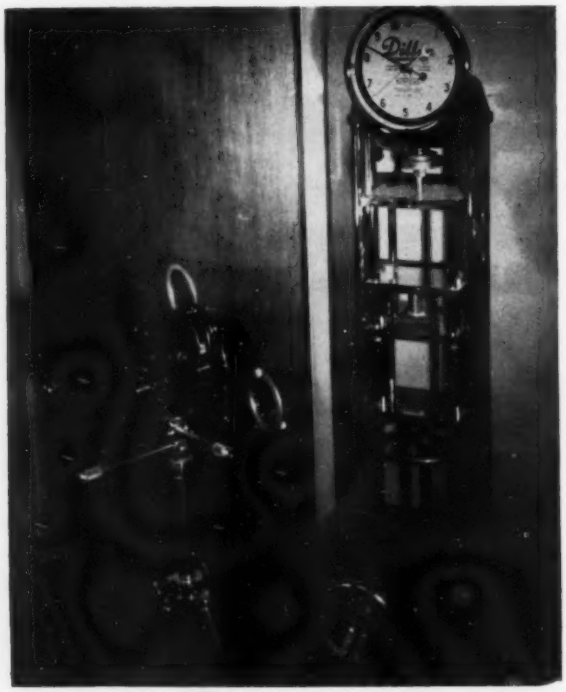
*Tuesday:* Ernest W. Monroe, Route 2 Box 273, Fort Collins, Colorado, guessing 12,280.

*Wednesday:* J. C. MacBeth, 1815 Pacific, Las Vegas, Nevada, who estimated 12,001.

*Thursday:* Mrs. A. M. Dixon, 204 Avenue B, Gabbs, Nevada. She guessed 12,111.

Each winner is now the pleased owner of a real gem diamond.

MOST SATISFACTORY photostress results have been obtained by bonding clear plastic sheets to the rock surface with a reflective type cement. This picture shows how the rectangular plastic sheet is firmly secured to rock. An excess of cement is used to assure a tight bond and is shown on laboratory specimen forming the ridges between the edge of the flat sheet and the outer edge of the rock. Plastic sheets are available in different thicknesses for sensitivity desired.



PHOTOSTRESS METER is an adjustable optical system and an illuminator mounted on a tripod with a universal head. The photostress meter and standard Dillon tester are shown. The optical system consists of two polarizers lying in the same plane; one serves as a polarizer for the light beam from the illuminator and the other serves as an analyzer through which the observer looks at the test specimen. Quarter wave plates here are swung out of position on both sides of the meter.

UNDERGROUND stress reading is made on pillar in the Colorado School of Mines experimental mine. Plastic can be glued to rock pillar, concrete pillar, or a steel set to determine any stress changes as mining proceeds in area.

# Photostress Makes

**by Niles E. Grosvenor**

The mining engineer is using a new tool—photostress—to design mines for more complete ore extraction with greater safety.

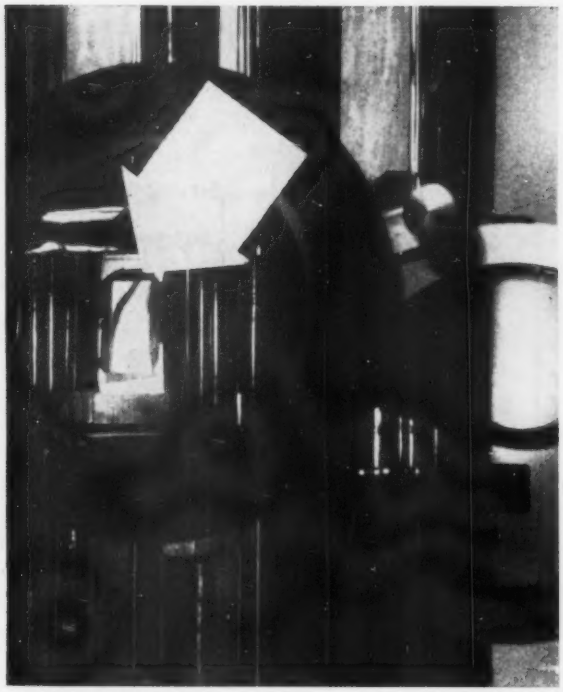
Photostress is a photoelastic technique, developed by Dr. Felix Zandman of the Instruments Division of the Budd Company. This technique consists of coating a rock with a special transparent plastic, and when a load is applied, strains are transmitted to the plastic coating.

The change in the plastic coating is observed by the use of the photostress meter which is a reflection type polariscope. This instrument makes it possible to determine the stress distribution on the surface area of any rock. The magnitude and direction of the principal stresses can also be determined.

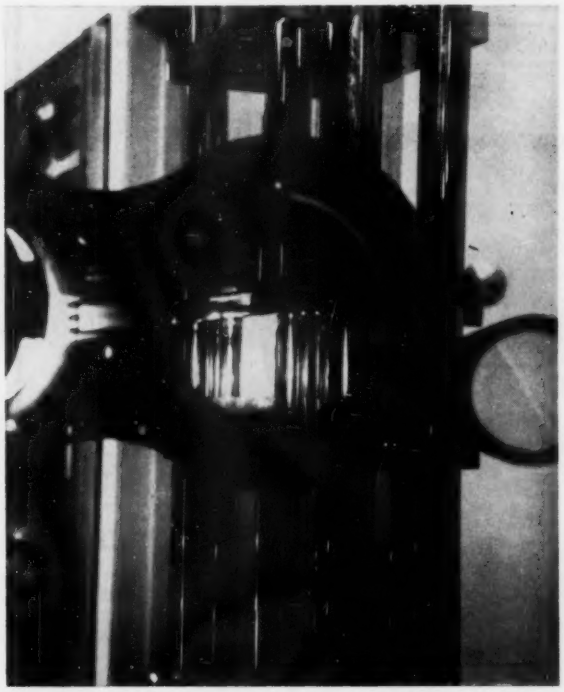
Photoelastic analysis techniques have been used by design engineers since the early part of the twentieth century. The phenomenon that the forced deformation of a transparent solid alters its optical properties was discovered by David Brewster in 1812. He found that the degree of optical anisotropy is proportional to the deformation of the material. This discovery and later investigations have made it possible to study models of clear plastic to determine the location of points or areas of greatest strain.

The advantages of photoelasticity are that it can be

Mr. Grosvenor is assistant professor of mining engineering, Colorado School of Mines, Golden, Colorado.



PICTURE THROUGH photostress meter shows rock specimen with coat of plastic glued on one side. Rock is under 5,000 pound per square inch vertical load. Dark areas at tip of arrow are isoclinics which are lines where direction of principal stresses are constant. These stress directions coincide with the axes of the polarizer and analyzer. By rotating the polarizer and analyzer it is possible to determine the directions of the principal stresses at every point on the model.



QUARTER WAVE PLATES have been added to the polarizer and analyzer to photograph same rock specimen. Now isochromatic lines are visible. These are lines of equal color. For each intensity of strain the color will be different. A non-uniform strain distribution yields variously colored striations which can be analyzed to determine magnitude. By changing instrument setting, magnitude and sign of strains can be continuously determined over the entire surface of the rock specimen.

# Underground Mining Safer

used in projected or corrected designs. It is cheap and can be precise. It gives an overall picture of the stress distribution in the model. If the model has been properly selected then it should represent the prototype.

In the photostress method, the plastic is bonded to the test object and the stresses are determined in the object under actual loading conditions. Conventional photoelastic techniques involve making a transparent plastic model and determining the stresses in this model under a simulated load.

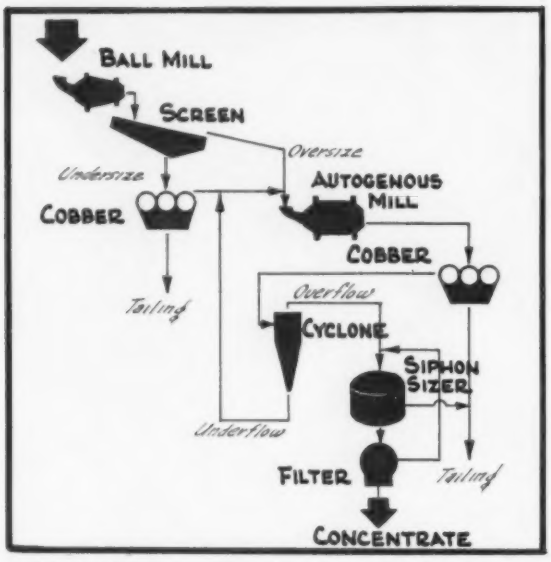
Photostress is essentially a surface strain technique and it differs from the strain gage technique in that the strains are quantitatively determined not only at areas where strain gages are located, but in a continuous manner at every point of the surface that is coated.

The photostress meter is not restricted to the laboratory. It is lightweight and can be used underground. The temperature range without corrections is minus 44° F. to plus 85° F. (with corrections minus 67° to plus 284° F.). Moisture does not affect the readings or the results. However, the photostress viewer is easily and quickly used underground to make a rough check to see if there are any major changes since a previous reading. If a major change is noted, then the photostress meter is set up and readings are taken.

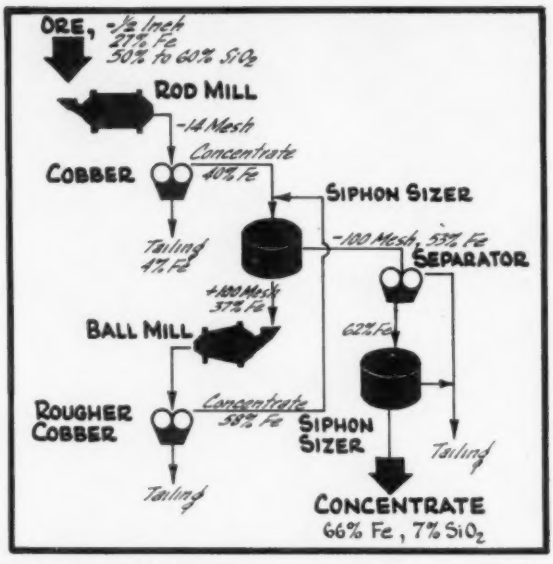
The average accuracy of the instrument is plus or minus-3-degrees for directions of principal stresses and the minimum measurable strain is plus or minus-20-micro-inches per inch.

The combination of these instruments makes it possible to determine the stress pattern and the deformation at any location as mining proceeds. It provides a means of following the life history of the stresses on any pillar or shaft lining. If properly applied, this method will detect stress concentrations or movements long before actual failure. The result—higher extraction, cleaner mining, and safer workings. END

PHOTOSTRESS VIEWER is simplest polariscope. The only light source necessary is a miner's electric cap lamp. The instrument is used only for approximate analyses to locate stress concentrations and estimate their magnitude.




TOMORROW'S iron ore flowsheet may well include autogenous grinding for extremely fine reduction in second stage.




PILOT PLANT testing shows several advantages for using the new SiphonSizer as a classifier and/or a deslimer.

# Autogenous Grinding and SiphonSizer Show Promise for Iron Ore Flowsheets

"Manufactured iron ore" grows in importance on the United States and Canadian iron ranges. The blast furnace operators raise furnace capacity, cut flux and fuel consumption, and reduce flue dust by using pellets, sinter, nodules, and concentrates. They want prepared feeds and it's up to the ore producer to meet their demands.

With the great success of the magnetic taconite plants in Minnesota and the coarser grained magnetic-hematites milled in Labrador, the majority of exploration and pilot plant work has been directed to these types of ores.

With fine grinding of concentrates mandatory for pelletizing, recent attention has been directed to ores in which the magnetite will only be released after grinding to minus-400-mesh. To economically achieve this fine a grind, metallurgists' attention has been directed to rock grinding, or autogenous grinding, or cascade grinding, whichever name you prefer. Pilot plant work is under way with a somewhat similar circuit to the one above, in which pebbles are circulated to a regrinding mill.

A more common variation of this flowsheet uses complete cascade type grinding with a coarse ore feed directly to a primary autogenous mill. From this fairly coarse ore pebbles are scalped off and sent directly to the regrind mill.

On some ores it has been found that autogenous grinding does not prepare the best feeds for subsequent concentration, desliming, and magnetic separation.

Many metallurgists believe that flotation is the best method to recover hematite from the mixed Canadian ores. Humphreys spirals have proved very simple and economical for recovering hematite from several ores. Coarse grained magnetite is also recovered by spirals.

A new and very promising piece of equipment has drawn the enthusiastic comments of many iron ore metallurgists. It is the Evans Siphon Sizer, now called the D-O SiphonSizer, manufactured by Dorr-Oliver Incorporated.

It is definitely too early to know all the uses and applications of this new piece of equipment, but it now looks as if it may have separate applications for many ores as well as multiple applications on certain ores.

Of primary importance is the fact that pilot plant testing of one iron ore indicates that the sizer obviates the need in the primary grinding circuit of two stage grinding.

Economic importance of this can't be over-emphasized. On other ores it will not operate when grinding is done in a cascade mill.

The flowsheet above shows how the sizer might have two applications in one circuit—first as a classifier and second as a deslimer. Note how coarse grinding, only to minus-14-mesh, is necessary before the first cobbing step. The sizer handles the cobber concentrate to yield a plus-100-mesh underflow for regrinding and a minus-100-mesh overflow for magnetic separation. Concentrate from this separator flows to another sizer which is a deslimer. The 62 percent iron feed is raised to 66 percent iron with 7 percent $SiO_2$. The overflow tailing contains 10 percent iron which might be regarded as high, but this fraction contains only 1.3 percent of the total iron in the original feed.

The autogenous grinding flowsheet shows how the sizer might be used as a dewaterer and a deslimer.

The sizer has been termed a hindered settling classifier featuring automatic control and discharge. Two-part classification is by coarse material settling through rising column of water while finer material is washed to overflow.

# NEWSMAKERS in world mining

L. LITCHFIELD, JR.

W. MITCHELL, JR.

R. JENKINS

J. S. SMART, JR.

**John W. Currie** has been named resident manager of American Zinc, Lead and Smelting Company's Spokane, Washington office. Prior to his appointment, he had been resident manager, mine superintendent, and general superintendent at the firm's Grandview mine and mill in the Metaline mining district near Spokane.

**H. Bogard** is now mill foreman with the Iron Ore Company of Canada at its Carol Project pilot plant, Seven Islands, Quebec. The Carol Project has been designed for testing ore and equipment for its large iron ore concentrator in the Wabush Lake area in Labrador, which will go into production in July 1962.

**P. S. Corr,** former mine manager at Canadian Dyno Mines Ltd., Bancroft, Ontario, is now manager of mines for Kermac Nuclear Fuels Corporation at Grants, New Mexico.

**Parke A. Hodges,** vice president of Behre Dolbear & Company, consultants to the mineral industries, New York, New York, is doing professional work in Australia.

**L. F. Stein** has been named general manager of Strategic Metals Research, Inc. of Rapid City, South Dakota.

**Bernard W. Bernstrom,** formerly associated with Pickands Mather and Company, Mesabi Iron Range, has joined the engineering department of the Raw Materials Division, Jones & Laughlin Steel Corporation in Pittsburgh, Pennsylvania.

**Harold E. Robbins,** former general superintendent of Andes Copper Mining Company at Potrerillos, Chile, has been promoted to assistant manager of the company. He will be in charge of the firm's El Salvador copper mine and concentrator project.

**L. Litchfield, Jr.** has been appointed president of the Aluminum Company of America. He has been associated with the firm for the past 25 years.

**Will Mitchell, Jr.** has been appointed acting director of the research division of Allis Chalmers Manufacturing Company. Mr. Mitchell, who joined the company in 1947, succeeds the late **Dr. H. K. Ihrig,** director of research. He was previously associate director of the research division.

**Dr. Paul F. Kerr,** Newberry professor of mineralogy at Columbia University, New York, New York, is spending eight weeks at the University of Oslo, Oslo, Norway, as NATO guest professor in the department of geology. Dr. Kerr is offering a sequence of graduate lectures and seminars devoted to recent research developments in mineralogy as carried on at Columbia.

**Dr. Siegfried Balke,** West German minister for atomic energy and hydro power, has been touring nuclear plants and uranium mining installations throughout Canada.

**Henry P. Ehrlinger III,** former assistant mill superintendent at the Santa Barbara unit of the American Smelting and Refining Company at Santa Barbara, Chihuahua, Mexico, has been transferred to ASARCO's Charcas unit, Charcas, San Luis Potosi, Mexico, as mill superintendent.

**Robert Blair,** chief consulting mechanical engineer, and **R. A. Mudd,** assistant consulting engineer (East Rand), for the Anglo American Corporation of South Africa, Limited, Johannesburg, have been visiting mining companies and manufacturing plants in Sweden, West Germany, the United States, and the United Kingdom.

**Ray Jenkins,** consultant in mining and construction, has joined the staff of The Ralph M. Parsons Company in Los Angeles, California. He has been associated in the past with the London Mines and Milling Company, Mountain City Copper Company, Anaconda Copper Mining Company, Joy Manufacturing Company, the mining and milling division of Phillips Petroleum Company and the mining division of Anderson Development Corporation.

**John S. Smart, Jr.,** general sales manager of the American Smelting and Refining Company, has been elected president of the Metallurgical Society of the American Institute of Mining, Metallurgical and Petroleum Engineers for 1961. Mr. Smart will take office during the AIME annual meeting next February in St. Louis, Missouri. He succeeds **Dr. Carleton C. Long,** director of research of the zinc smelting division of St. Joseph Lead Company.

**Gunter J. Bilstein,** who has been associated with **Cook Brothers** in Oakland, California, as an air tool specialist, recently accepted an appointment in Lima, Peru with Minerco, ore buying firm of Philipp Bros. Ore Corporation.

**Sven E. Sjöberg,** assistant manager, Stora Kopparbergs Aktiebolag of Falun, Sweden is making a tour of United States and Canadian mining operations to collect information on autogenous grinding. He is accompanied by **Torbjörn Thoring** and **Claes Lundqvist** superintendents respectively of the Tuna Hasberg iron-manganese and Risberg iron mines.

**Norton Jackson,** manager of mining chemicals, Cyanamid Australia, Ltd., Melbourne, Australia has been visiting base metal mines and mills in the United States and Cyanamid's ore dressing laboratory at Stamford, Connecticut.

B. W. BERNSTROM

H. E. ROBBINS

R. BLAIR

R. A. MUDD

S. E. SJÖBERG

N. JACKSON

YOUR

# PROCESS

BECOMES

# PRODUCTION

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The plant that will effectively and economically implement your chemical or metallurgical process is one designed, engineered, erected, equipped and tested by Stearns-Roger engineers. Our service can save you months of lost time getting into production and avoiding trial and error in bringing operations up to design capacity. For over half a century Stearns-Roger plants have been known as the best that the technical skills can produce. When you begin to plan facilities, consult Stearns-Roger.

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# PRODUCTION EQUIPMENT preview

FOR DATA ON ANY ITEM IN THIS SECTION PLEASE USE YELLOW INQUIRY CARD OPPOSITE PAGE 52

## Two New Rear Dumpers Offer Many Advanced Features to the Mining Industry

Mack Trucks, Inc. has offered two new rear dump trucks to the mining industry. They are the M-30X, a four-wheel vehicle, and the M-45SX, a 45-ton, six-wheel unit.

The M-30X has many of the engineering and design features of its companion model. It offers the stamina, long life, operating economy and versatility of the larger unit in a 30-ton four-wheel dumper chassis for those who require the greater maneuverability afforded by a four-wheel chassis but who do not require the M-45SX's larger capacity.

The backbone of the new M models is strong, durable all-welded special alloy steel frames which are designed to withstand the most jarring impacts of huge shovel loads. Positive braking control, regardless of load, is provided by front air brakes and rear air-hydraulic brakes on both trucks.

The M-30X features a six-cylinder Diesel engine which develops 320-horsepower at 2,100 rpm. A 380-horsepower Diesel is offered as optional. Other standard features are 18:00 by 25 tubeless 28-ply tires on 13:00 rims, two lever selective constant mean transmission with eight forward speeds and two reverse, and two-plate dry air-assist clutch.

The M-45SX is powered by a naturally aspirated V-12 Diesel engine which develops 450-horsepower at 2,100 rpm. Other V-12 Diesel engines are available as optional equipment. Standard features are eight-speed overgear transmission, foot activated air assist clutch, Mack 50-horsepower takeoff, 18:00 by 25 tubeless tires on 13:00 rims. Circle No. 1.

### Basket and Coat Hanger

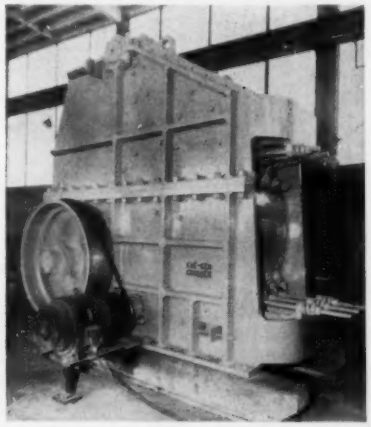
The Moore Company of Charleston, West Virginia, announces the development and production of an entirely new concept in overhead clothing storage, featuring both self-locking garment hooks and the patented Sur-Hold coat hanger with vertical coat stabilizers.

The new Moore Lockerbasket provides secure, sanitary, ventilated overhead storage of clothing and personal effects. The coat hanger permits garments to hang naturally, exposed to circulating air, yet the design of the hanger prevents the garments from slipping when the unit is in the elevated position. Circle No. 3.

### Electrical Faultfinder

To fulfill special requirements of the mining industry, the Brunt Faultfinder has been designed to cut production losses by locating accidental grounds quickly—without shutting down operation.

Offered by Parr Manufacturing Corporation, the Faultfinder is a combination ground detector and fault finder. Imposing only two amperes on the circuit, the Faultfinder cannot damage equipment on the line. It easily locates trouble on power systems, both AC and DC, up to 600 volts while the system is energized, thus alleviating production shutdown. Weight is 18 pounds. Circle No. 4.



### Improved Crusher Design

A massive 48" x 42" jaw crusher with an exceptionally small flywheel starts with a 30 hp normal duty motor and operates at full load on a maximum of 150 hp. Excess power required to elevate an eccentric jaw is eliminated by a swinging jaw mounted on a hinge pin in the center line of the crushing zone. Increased leverage plus elimination of excess weight on reciprocrating parts permits a smaller flywheel. Driven by a single vee belt, it runs empty at 17 hp; under full load at 100 hp to 150 hp depending on setting. Manufactured by Straub Manufacturing Company, California. Circle No. 2.

# 27

## TYPES AND SIZES

of

## ROPE MASTER

SLUSHER BLOCKS

No. 508 — One of a new series designed for big slushers that utilize shaft ropes. Built to withstand the extreme abuse of such service.

ROPE MASTER MINING BLOCKS
ARE AVAILABLE WITH THESE FITTINGS

SWIVEL HOOK
PLAIN SHACKLE
SWIVEL SHACKLE
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SAFETY SWIVEL HOOK
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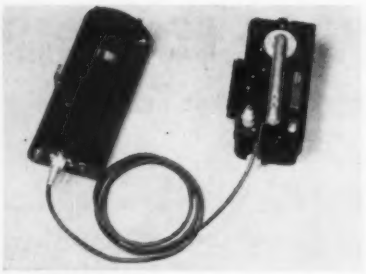
**1125 S. E. Grand Avenue**
**Portland 14, Oregon**

## Differential Scanner

The Model VLS Differential Scanner made by Urinco of Grand Junction, Colorado, is a gamma counting radiometric probe which permits separation of background radiation from that radiation originating from an ore face or stock pile. When the ore face or stock pile are equal in volume to an infinite hemisphere (18 inch radius) and the material is in radiometric equilibrium, an evaluation of the contained $U_3O_8$ may be made by obtaining a difference between two count rates read out on a transistorized counter, adapted for this application. The difference between these two count rates, when multiplied by a coefficient, will yield the percent of contained uranium. The scanning method assumes that the sample being assayed has constant mass absorption, which condition is typical of any particular mining area. Circle No. 34.

## Project Engineering Service

A new 12-page brochure describes Dorr-Oliver Inc. of Connecticut, U.S.A., as a source of engineering services in the development of complete plants on a world wide basis. Services include testing, pilot plant demonstration, flowsheet preparation and engineering studies, cost estimates, design and specifications, erection and construction, supervision of initial operation and personnel training for nearly all types of recovery, beneficiation, metallurgical and production plants in the mining and chemical fields. Circle No. 35.

## Ideal All-Steel Building

A multi-purpose pre-fabricated steel building, the Spartan, has been developed by Martin Steel Corp. for heavy-duty service. Ideally suited for the mining industry, it is a functional building perfect for a variety of utilitarian purposes: office, bunk-house, commissary, equipment storage, etc. Fireproof and rust-resistant, the Spartan has been safety-engineered and precision-constructed featuring full-strength durability and long-lasting service. Circle No. 31.

## Low-Cost Blasting Agent

A new low-cost, efficient, premixed blasting agent for use in mining, quarrying, construction, and petroleum exploration has been announced by the Du Pont Company.

"Nilite" 101 nitro-carbo-nitrate blasting agent, which can be used in holes as small as two inches in diameter, is now available in 50-pound bags for delivery throughout the country. It has had extensive laboratory and field testing.

The new blasting agent has several specific advantages over the combination of ammonium nitrate prills and fuel oil mixed in the field. "Nilite" 101 is free-flowing and provides greater assurance of uniformity in blasting. These properties save time in blasting, increase production efficiency and reduce maintenance costs on equipment. It also improves performance of delay blasting systems. The product is not cap sensitive and requires a primer to detonate it. Circle No. 32.

## Effective Spray for Burns

Burn-Quel has been designed by the A. E. Halperin Company of Boston, Mass. to provide adequate relief by the medium of a spray for treating burns and scalds. Burn-Quel is effective in treating all types of burns and eliminates the necessity of cleansing the affected area. It will make a valuable addition to medical cabinets and first aid kits in both industry and the home. Circle No. 49.

## Two New Rock Bits Developed

Western Rock Bit Manufacturing Company of Salt Lake City has developed two new "one use bits" for dustless vacuum type drills. The WRB Tee Cee type TCVA or TCVB is a shallow tungsten-carbide insert bit for either class A or class B taper connections. This long-life heavy-duty tungsten carbide insert bit needs no resharpening. It was designed by WRB engineers to provide operators with low-cost footage. The WRB type SLVA or SLVB bit is a low-cost "used to destruction" steel bit. The outstanding feature of the steel bit is its pilot construction and wing design. The pilot chips the rock ahead of the cross wings and eliminates the pulverizing action common to conventional cross bits.

Both types of bits are of 5-hole design and are interchangeable. Circle No. 92.

# MORE NEW EQUIPMENT . . . AND NEW LITERATURE

**DRILL STEEL** treated with the exclusive Sandvik process is protected against corrosion and provides from 30 to 50 percent longer life than untreated steel according to Atlas Copco. Circle No. 45.

**ROTARY KILNS** to meet specific needs are the specialty of Traylor Engineering & Manufacturing. Their modern kilns feature full-floating type roller ring and roller supports which insure easy alignment, continuous operation and low maintenance costs. Circle No. 46.

**WASTE HEAT PROBLEMS** are the subject of The Babcock & Wilcox Company's Bulletin G-88 "Effective Utilization of Waste Heat", which is available to all interested in heat recovery systems. Circle No. 47.

**AIR SEPARATORS:** Bulletin No. 087 describes Sturtevant separators which classify sand without water. The text points out that pre-classification by air can increase screening production by removing screen blinding fibers. Circle No. 50.

**LABORATORY MACHINERY** is described in Bulletin 576A by Morse Brothers Machinery Company. This illustrated booklet contains complete specifications and prices on all laboratory equipment made by the company. Circle No. 51.

**CORE BARREL** that performs where others fail is the Acker-Denison core barrel which obtains undisturbed top quality cores from rare earths, clays, and soft difficult formations. Circle No. 52.

**VENTILATION TUBING** that is tough, durable, easy to install and remove, lightweight, and made of long-lasting materials is described in Bulletin 360 issued by the American Brattice Cloth Corporation. Circle No. 53.

**DRAGSCRAPER** storage and reclamation is described and illustrated in the new 28-page catalog just issued by Sauerman Brothers, Inc. Circle No. 66.

**CONCENTRATING TABLE:** The Super-Duty Diagonal Deck table manufactured by the Deister Concentrator Company is the subject of their bulletin No. 118C. Low cost and high mineral concentrating efficiency are the features of this table. Circle No. 16.

**CARTOON BOOK** titled "Henry's Crawler" just published by the J. I. Case Company encourages operator acceptance of instructions on care and maintenance of equipment. For a free copy circle No. 17.

**LIFT CRANE** Model 4000 is described in a new 8-page catalog just released by the Manitowoc Engineering Company. This new machine is said to be one of the biggest capacity lift cranes in existence. Circle No. 18.

**SPEED REDUCERS:** A new 12-page brochure containing technical information on shaftmounted geared speed reducers as well as illustrations, descriptions, and selection instructions on the U. S. Shaftmount Syncrogear is now available from U. S. Electrical Motors, Inc. Circle No. 20.

**RECLAIMING ALUMINA** from former waste is described in a new bulletin offered by Fuller Company. The four-page, illustrated report details the system now in operation at the Bayer Plant of Alcoa. Circle No. 21.

**DRILLING EQUIPMENT:** A new 12-page bulletin containing data and operating information on a complete line of crawler mounted drilling equipment is now available free from Gardner-Denver Company. Circle No. 80.

**SHOVEL-CRANE:** The Thew Shovel Company has just released a 12-page catalog on their Lorain 50, a 25-ton, 1-yard crawler mounted shovel-crane. Circle No. 30.

**LIQUID SHIM:** Loose-fitting electric motor end-bell bearings are now easily repaired with the new Loctite plastic sealant made by the American Sealants Company. For more information circle No. 23.

**SILICONE INSULATION** for wire and cables is the subject of a new descriptive manual published by Dow Corning Corporation. With data charts and graphs, the brochure explains why Silastic insulated wire and cable has much greater load carrying capacity. Circle No. 56.

**SCREW WASHERS** are the subject of a new 8-page technical bulletin offered by McLanahan & Stone Corporation. Their new series of single and double washers have many significant design changes for more efficient operation. Circle No. 33.

**GYRADISC CRUSHER** is described in a new 4-page bulletin released by Nordberg Manufacturing Company. Details are given on this revolutionary method of comminution, a process of alternately impacting and releasing a thick mass of material, and the unique feed arrangement to assure thorough mixing. Circle No. 36.

**SYNCRO-RANGE DRIVES** are described in Bulletin 111 issued by the Louis Allis Company. Models range in size from 2 to 15 hp, and provide adjustable speed of synchronous induction motors running in exact synchronism over a wide range of speeds. Circle No. 37.

**CONVEYOR BELT** called Bostron has a hazard-proof carcass reported to be a remedy for many operating causes of premature belt failure including moisture, impact, fatigue, chemicals and acids according to Boston Woven Hose and Rubber. Circle No. 26.

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| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |

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|---|---|---|---|---|---|---|---|---|---|
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

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To Attention of ..... Address .....

City ..... Zone ..... State ..... Country .....

IMPORTANT: Following information must be given to insure prompt reply:

Nature of your firm's business .....

(Such as: mining, consulting engineers, government, etc.)

Your exact title, job or position .....

(Such as: mine supt., mill foreman, mining engineer, managing director, etc.)

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"CONDULETS for Corrosive Locations" is the title of a 20-page Crouse-Hinds bulletin just reissued with additional information. The company manufactures electrical equipment for use under many different conditions causing corrosion. Circle No. 24.

INDUSTRIAL EQUIPMENT line of Massey-Ferguson is described in their new 24-page, full-color catalog-type brochure. Photographs, drawings, operating information and specifications are given. Circle No. 38.

EXPLOSIVES is the title of an attractive brochure released by the Nihon Yushi Co., Ltd. of Tokyo, Japan. Details are given on all their industrial high explosive products and blasting accessories. Circle No. 67.

CONTINUOUS PROCESSING is the title of revised bulletin 7004 that lists and illustrates the distinguishing characteristics and applications of 55 types of continuous processing equipment manufactured by Dorr-Oliver, Inc. of Connecticut. Circle No. 68.

HEAT TRANSFER: The importance of using fintubular construction in metallic recuperators to obtain longer life with less maintenance is explained in a new 8-page booklet published by Brown Thermal Products Corp. Circle No. 69.

METALLURGICAL services offered by the Charles C. Kawin Company of Chicago and Buffalo are described in a new brochure just issued by the company. The attractive publication contains illustrations of their testing and analysis facilities. Circle No. 71.

INDUSTRIAL WATER consulting service of the Hall Laboratories is described in a new 24-page booklet which discusses the whole range of industrial water problems. Circle No. 72.

AUTOMATIC SAMPLING is the subject of Bulletin 47-A issued by the Hardinge Company. This 8-page catalog describes in detail the re-designed Hardinge automatic sampler. Circle No. 73.

PARTS AND SERVICE: The importance of using genuine Allis-Chalmers parts and service is being stressed by Allis-Chalmers International whose distributors offer specialized service and facilities. Circle No. 74.

TRUCK CRANES manufactured by Harnischfeger outproduce on many utility jobs. The versatile P & H truck cranes are equipped with Magnetorque swing and other features for efficiency and low cost. Circle No. 77.

SPEED REDUCERS for every purpose are made by Hewitt-Robins who have recently published Bulletin 9-41 describing their complete line of Jones equipment. Circle No. 78.

PLASTIC PIPE is described in a 36-page bulletin released by the Kraloy Plastic Pipe Company, Inc. Illustrations, specifications, uses and engineering charts are detailed in this useful catalog. Circle No. 79.

PUMPS are the subject of a new brochure now available from W. R. Barry Pump Company. Barry pumps are now being manufactured in sizes 150 to 1,250 hp, pressures 500 to 20,000 in V60 quadruple plunger type. Circle No. 41.

EQUIPMENT for the process industries is described in a comprehensive new 12-page, two-color bulletin offered free by the Fuller Company. Circle No. 64.

FILTER: A large single element full-flow controlled pressure filter, having two flow rates in one element, will replace their popular multi-element filters according to the Winslow Engineering & Manufacturing Company. Circle No. 65.

DRUM HOISTS are illustrated and described in a new 20-page brochure available from the Vulcan Iron Works Company. A wide variety of Vulcan-Denver mine and utility hoists are listed. Circle No. 54.

LIQUID-SOLIDS separation equipment for chemical and metallurgical processing is described in a new 4-page condensed catalog recently released by The Eimco Corporation. Circle No. 55.

CONVEYING SYSTEMS is the title of a 16-page bulletin just issued by The Day Company that illustrates and explains efficiency gains possible with Day low density or high density conveying systems. Circle No. 58.

TRAXCAVATORS: Design and engineering details of the 966, largest of Caterpillar's wheel Traxcavator line, are described in a 12-page book just released by the company. Circle No. 59.

ORE WASHING equipment is described in Bulletin 760 just released by the Eagle Iron Works. Washing and dewatering equipment for ore and non-metallic scalping-classifying tanks is detailed. Circle No. 61.

WORK GLOVE buyers are offered a new selector manual by the Riegal Textile Corporation covering basic types and styles of work gloves. The manual is complete with information on basic cuts, cuff styles and other specification details. Circle No. 62.

DIESEL and carbureted engines are detailed in a new, three-color pamphlet issued by the International Harvester Company. Descriptions of 27 models—in four, six and eight-cylinder versions—are described. Circle No. 22.

ROCK BITS, drill steels, moil points, clay spades, pneumatic tool accessories and other products of Brunner & Lay are described in their new catalog. Circle No. 42.

MINING EQUIPMENT designed to increase automation in the non-metallic mining and manufacturing industries is pictured and described in a new four-page bulletin now being offered by Fuller Company. Circle No. 40.

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# WHAT'S GOING ON in mining

## Pitkin Produces Iron Ore From Aspen District Mine

Ore extraction by power shovel began recently at the iron mine being developed by Pitkin Iron Corporation in the Aspen district of Colorado. The deposit crops out at an 11,500-foot elevation on Taylor Peak near Castle Creek.

Mining of the high grade ore is expected to be confined to a three-month period each year because of winter. A four and a half mile access road leading upward on a constant eight percent grade was built this summer by Morrison-Knudsen Company, Inc., which has the contract for the operation.

Pitkin Iron was organized by principals of Mid-Continent Coal & Coke Company which is operating the Dutch Creek coal mine, another sky-high operation in the same area. The Dutch Creek project, also a Morrison-Knudsen operation, is 10 miles away from the iron deposit, as the crow flies, but 70 miles by road.

# Colorado

A barge-mounted pumping plant scheduled to be in operation this month has been installed by **Climax Molybdenum Company** at its Climax, Colorado, mill. The barge and its connecting lines replace the east gravity line previously used to decant water from Robinson Tailing Pond Lake. The four-component barge, anchored some 80 feet from the southeast shore of the pond, has three 6,000-gallon-per-minute electric pumps. Reclaimed water for use in the mill is pumped to shore through two 16-inch pipes supported from barge to shore by seven steel pontoons. At the shoreline, water enters a 30-inch pipe line to be carried up a vertical rise of 120 feet to a junction box. From the box water flows by gravity through a 36-inch pipe line to McNulty Canal one-half mile distant, where it enters the water return system.

Production at the **Boomer** mine of **U. S. Beryllium Corporation** this past year was four times more than in any previous year, totalling over 1,200 tons. Ore presently mined and stockpiled for delivery to **Mineral Concentrates & Chemical Company** for processing is of commercial grade, some assaying as high as 14 percent beryllium oxide content. According to Don H. Peaker, president of the firm, U. S. Beryllium has more commercial grade beryllium ore mined, stockpiled and blocked out underground than any other beryllium mining operation in the United States. The Boomer mine is located on Badger Flats in Park County, Colorado.

**The Atomic Energy Commission** has extended its uranium concentrate purchase contract with **Climax Uranium Company** of Grand Junction, Colorado, to December 31, 1966. The Climax uranium-vanadium ore processing mill will continue to operate at approximately its present daily rated capacity of 330 tons. The contract extension to 1966, first in the Uravan Mineral Belt of Colorado, contains provisions which reserve a portion of the mill capacity for independent ore producers in the area.

**Denver Golden Oil & Uranium Company** reports good progress in driving its Burbank Tunnel in the Clear Lake district of San Juan County, Colorado. The company is building a road above Clear Lake because additional exploratory work on outcrops at higher levels is planned.

# South Dakota

The two-year expansion program that **Homestake Mining Company** is starting at Lead, South Dakota will include addition of a rod mill to the ball mill unit at the gold treatment plant. The addition will provide four sets of rod mill and ball mill grinding units in the south mill and increase mill capacity from about 4,800 tons per day to about 5,600 tons. The west sand treatment plant will be enlarged by installation of four new vats on the west side, and a covering annex. Underground expansion will include a new ore hoist and skipping arrangements at the No. 4 winze on the 4,850-foot level to handle ore from deeper levels, along with extra installations for power, haulage, sand filling, and pumping. According to James O. Harder, general manager, ore bodies on levels below the 5,000-foot have not yet been developed in sufficient detail to warrant their inclusion in published reserves of measured ore. Enough tonnage is indicated, however, to justify the proposed expenditures. The expansion program will extend the life of the mine and make it easier to meet physical difficulties of mining at greater depths, Harder said.

## Camp Bird Starts Production at New Flotation Mill

Production at the famous Camp Bird mine and new 500-ton-per-day flotation mill began October 10, culminating a four-year development and construction program costing some $2,500,000. Owner of the operation in Ouray County, Colorado, is Camp Bird Colorado, Inc., subsidiary of Camp Bird Mining Ltd. of London, England.

The new mill is built at the entrance to an 11,000-foot tunnel which was driven into the San Juan Mountains to serve the old mine workings. Ore from the new workings is hauled to the mill via this tunnel in an operation that will continue the year round despite the 10,000-foot altitude.

Ore reserves, which have been increased in the last year, now exceed six years' supply to the mill. A year ago the reserves were reported as 777,000 tons, averaging 0.0325 ounces gold, 4.38 ounces silver, 4.96 percent lead, 0.535 percent copper, and 4.34 percent zinc per ton over a width of 73.9 inches, representing a net smelter return of $14.97 per ton of ore Operating costs have been estimated at not over $10 per ton of ore.

The Camp Bird project has included an increased supply of electric power, water supply, road facilities, both underground and surface machinery, houses, office, stores, tailing disposal and other requirements. The track in the main haulage tunnel has been widened and provision made for increased ore output.

The overall capacity of the mill can simply and at relatively small cost be increased to 1,000 tons a day, since the crushing unit is capable of handling the present amount of 500 tons in a single eight-hour shift.

Lead-copper concentrate from the mill will go to the El Paso, Texas, smelter of American Smelting and Refining Company, while the zinc concentrate will go to that firm's Amarillo, Texas smelter. Gold and silver will also be produced and sold directly to the United States mint at Denver.

Space has been provided in the new mill for installation of a copper flotation circuit at small cost for recovery of copper concentrates separately should later circumstances justify this.

# "ON OUR GRANTS, NEW MEXICO WORK FLYGT PUMPS ARE THE ONLY PUMPS WHICH CAN DO THE JOB,"

reports

## BOYLES BROS. DRILLING CO.

### Salt Lake City, Utah

Well-known as mining contractors, engineers and geologists, Boyles Bros. Drilling Co. are sinking a variety of shafts in the famous Ambrosia Lake uranium district near Grants, New Mexico. The roster of Boyles Bros.' customers includes leading names in the mining and petroleum industry — firms which demand efficient equipment to obtain top performance. When it comes to dewatering, Boyles Bros. depend on Flygt Electric, Submersible Pumps.

Boyles Bros.' Mr. Victor L. Stevens, in his own words, puts it this way: "We have on our shaft jobs in Grants, New Mexico, 3 Flygt B-150s and 9 Flygt B-80Ls, and these pumps are solving the big problem in the Grant s area, which is abrasive sand particles wherever water is encountered.

"We are using the Flygt B-150s and B-80Ls to handle a good part of our water, and they are very successful pumps. We feel that Flygt pumps are the only pumps that we know can do our job.

"We are concreting as we sink some of the shafts. When we hit water a lot of the cement washes out of the concrete lining and it is handled by the Flygt pumps. Where we were cement grouting off the water, a large amount of the cement went into the shaft and was pumped out by the Flygt Pumps," Mr. Stevens concludes.

Additional satisfied users of Flygt Pumps in mining applications include Climax Molybdenum Mines in Colorado, Inspiration Copper Mine in Arizona, Kermac Nuclear Fuels in New Mexico, Lucky Friday Silver-Lead Mines in Idaho, Utah Construction Co. in San Francisco, San Manuel Copper Mine in Arizona, White Cap Gold Mining Co. in Nevada, and others.

Flygt Electric, Submersible Pumps range from 1½" 85 gpm to 8" 3100 gpm capacity. Heads to 220'. Higher heads are possible with Flygt Pumps in tandem. Ask today for literature and an on-the-job demonstration.

### CHECK THESE FLYGT FEATURES

- Electric
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- Submersible
- Easy to Handle
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- Will Pump High Amount of Solids
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# Metal & Mineral Prices

## U.S.A.

### METALS

October 21, 1960

COPPER: **Electrolytic.** Delivered F.o.b. cars, Valley basis (pound) ..... 30.00¢
**Lake.** Delivered, destinations, USA ..... 30.00¢
**Foreign.** Delivered, destinations, USA ..... 30.00¢
LEAD: **Common Grade.** New York (Per pound) ..... 12.00¢
**Tri-State Concentrate,** 80% lead, per ton ..... $141.72
ZINC: **Prime Western:** F.o.b. E. St. Louis (Per pound) ..... 13.00¢
**Prime Western:** Delivered New York ..... 13.50¢
**Tri-State Concentrate,** 60% zinc per ton ..... $80.00
ALUMINUM: **Primary 50 Pound Ingots (99.5% plus)** (Per pound) 26.00¢
ANTIMONY: **Lone Star Brand. F.o.b. Laredo, in bulk** (Per pound) 29.50¢
BISMUTH: (In ton lots) price per pound ..... $2.25
CADMIUM: **Sticks and bars.** 1 to 5 ton lots Price per pound .. $1.60
COBALT: **97-99%,** keg of 500 pounds (Price per pound) .... $1.50
COLUMBIUM: **Ingot** ..... Nom., per pound $55.00-$85.00
GERMANIUM: dioxide, high purity, gram ..... 29.95-36.95¢
LITHIUM: **98%** (per pound) ..... $9.00-$12.00
MAGNESIUM: **Ingots (99.8%)** F.o.b. Velasco, Texas per pound 36.00¢
MERCURY: **Flasks.** Small lots, New York ..... $208.00-$210.00
NICKEL: **"F" Ingots (5 pounds).** F.o.b. Port Colbourne, Ontario 75.50¢
PLUTONIUM. To July 1 1962 AEC will pay $30.00 to $40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram ..... $30.00
SELENIUM: **99.5% per pound** ..... $6.50-$7.00
TELLURIUM: Common grade, Per pound ..... $4.00
THORIUM: per kilogram ..... $43.00
TIN: **Grade A Brands.** New York (Per pound) Prompt delivery $103.12¢
TITANIUM: **99.3%** + Grade A-1 Sponge (Per pound) ... $1.50-$1.60
URANIUM: **Rod** (0.790 U-235) $16.00 Per Pound; Foil ..... $16.75
U-235: **Nominal** (Per pound) ..... $7.725
GOLD: **United States Treasury Price** ..... $35.00 per ounce
SILVER: **Newly mined domestic.** U.S. Treasury price per ounce 90.5¢
**Foreign** Handy Harmon ..... 91⅜¢
PLATINUM: Per ounce ..... $82.00-$85.00
ZIRCONIUM: **Sponge,** Per pound, Reactor Grade ..... $5.00

### ORES AND CONCENTRATES

BERYLLIUM ORE: **10 to 12% BeO.** F.o.b. mine, Colorado $46.00 per unit Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $48.00.
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons.
**African (Rhodesian). 48% $Cr_2O_3$. 3 to 1 Ratio** ..... $35.00-$36.00
**African (Transvaal). 48% $Cr_2O_3$. No ratio** ..... $26.00-$28.00
**Turkish, 48% $Cr_2O_3$. 3 to 1 chrome-iron ratio** Nominal $36.00-$37.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal $1.10
IRON ORE: **Lake Superior. Per gross ton Lower Lake Ports**
**Mesabi, Non Bessemer, 51.5% Fe** ..... $11.45
**Mesabi, Bessemer, 51.5% Fe** ..... $11.60
**Old Range Non Bessemer** ..... $11.70
**Old Range Bessemer** ..... $11.85
**Lump:** Plus ½-inch ..... $12.85
**Fines:** Minus ½-inch ..... $10.72
**Swedish,** Atlantic Ports, 60 to 68% Fe Contracts, Per Unit ..... 24.00-25.00¢
MANGANESE ORE: **Metallurgical grade.** 48 to 50% Mn Long ton unit ..... $0.95-$1.00
**Metallurgical grade.** 46 to 48% Mn. Long ton unit .... $0.90-$0.95
**Metallurgical grade.** 44 to 45% Mn. Long ton unit .... $0.85-$0.90
**Domestic** U.S. Government, GSA Basis $2.30 per unit for 48% Mn.
MOLYBDENITE CONCENTRATE: **90% $MoS_2$ F.o.b.** Climax, Colorado. Per pound Mo, plus container cost ..... $1.25
TUNGSTEN CONCENTRATE: **Domestic.** 60% $WO_3$ Per short ton unit ..... Nominal $24.00
**Foreign:** 65% $WO_3$ Per short ton unit (Scheelite) .. Nominal $20.25
**Foreign:** South American, Spanish, Portuguese .... Nominal $20.00
URANIUM ORE. F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is $1.50 per pound of $U_3O_8$ in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.

### NON-METALLIC MINERALS

BARITE: Oil well drilling. Minimum **4.25 specific gravity,** per short ton ..... $16.00
BENTONITE: **Minus-200mesh.** F.o.b. Wyoming. Per ton, carload lots ..... $12.50
**Oil Well grade.** Packed in 100 pound paper bags ..... $14.00
BORON: technical grade .. F.o.b. Boron California. Per ton .. $47.50
FLUORSPAR: **Metallurgical grade.** 72.5% effective $CaF_2$ content per short ton F.o.b. Illinois-Kentucky mines ..... $37.00-$41.00
**Mexican.** 70% F.o.b. border ..... $28.00-$29.00
**Acid Grade.** 97% $CaF_2$ Bulk, F.o.b. mine ..... $45.00-$49.00
PERLITE: **Crude:** F.o.b. mine per short ton ..... $3.00 to $5.00
**Plaster grades.** Crushed and sized. F.o.b. plants .... $7.00 to $9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas .... $22.50-$23.50

## London

October 21, 1960

| | | Per Long Ton | USA Equivalent | cents per pound |
|---|---|---|---|---|
| COPPER: | Electrolytic spot ..... | £222 | 15s 0d | 27.84¢ |
| LEAD: | Refined, 99% ..... | £ 67 | 0s 0d | 8.38¢ |
| ZINC: | Virgin 98% ..... | £ 87 | 10s 0d | 10.94¢ |
| ALUMINUM: | Ingot, 99.5% ..... | £186 | 0s 0d | 23.25¢ |
| ANTIMONY: | Regulus, 99.6% ..... | £197 | 10s 0d | 24.69¢ |
| TIN: | Standard, 99.75% ... | £807 | 10s 0d | 100.94¢ |
| TUNGSTEN: | Long ton unit ..... | £ 0 | 145s 0d | $20.30¢ |

*With Sterling Pound at $ 2.80

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*

# Utah

If **Texas Gulf Sulphur Company** carries out, as expected, its plans to enter the potash field, a plant with a capacity of 10,000 tons of ore daily will be built in southeastern Utah. Texas Gulf last spring signed an agreement with **Delhi-Taylor Oil Corporation** which gives the sulphur producer until January 1, 1961, to acquire leases to the rich potash land and commercially develop them. Most of the potash reserves are on government-owned land leased earlier by Delhi-Taylor. Evaluation of reserves is being completed and reports indicate the land in the Cane Creek district, near Moab, is one of the country's richest potash areas. Cost of the new project is estimated as between $20,000,000 and $30,000,000.

**Central Oil and Mining Company** of Salt Lake City, owners of the once-abandoned **Delta** uranium mine in Emery County, Utah, plan to boost ore production to 1,500 tons monthly by the end of the year. The famous Delta, once sold by prospector Vernon Pick to Floyd B. Odlum of Atlas Corporation for over $9,000,000 was relocated in March by Maxwell Bentley and Ralph Hafen. Bentley is now general manager of Central Oil and Mining Company. Present plans call for enlarging the open pit operation at the Delta property to include pulling of pillars left in the front part of the mine. The new owners are presently concentrating on producing all the ore possible before March 31, 1962, when the Circular Five purchase program of the AEC ends. The property has produced only about 2,000 tons since the Bentley-Hafen relocation. **McFarland and Hullinger** of Tooele, Utah, are removing overburden to prepare for mining by Owen Malan of Moab, Utah, Central's lessee.

Evidence of high grade silver-lead-zinc mineralization has been reported in the **Keystone Mining Company** properties in the Park City district of Utah, which are being developed by Keystone and **United Park City Mines Company.** The two-foot showing was cut when the firm raised on the ore after drilling from the 900-foot level. Earlier, ore had been located by a hole that went into the area called the Janey section. Mineralization will be followed to intersect with the formerly productive Crescent fissure in hopes that values will increase with approach to the Crescent. Drilling has also intersected a two-inch stringer of ore on the 200-foot level, almost directly above the two-foot showing, indicating possibility of ore deposits in several host zones between the two levels. The joint venture, aided by an OME loan, is designed generally for driving a drift of about 1,500 feet parallel to the Crescent, with stations to be cut at intervals for drilling toward the fissure. Cross-cutting toward the Crescent will be carried out from other stations.

**Stauffer Chemical Company** will build a fertilizer plant at Vernal, Utah, to utilize large deposits of phosphate ores in the area. The new plant, which will be built by the end of 1962, will be larger than the Salt Lake City plant of **Western Phosphates,** Stauffer affiliate, which produce 150,000 tons of fertilizer annually. Phosphate reserves in the Vernal area, about 125 miles east of Salt Lake City, are estimated at 700,000,000 tons of low grade ore. Lack of electric power in the area has prevented development of the deposits. The new plant will get its power from the $80,000,000 Flaming Gorge Dam scheduled for completion in two years.

At the Arthur mill of **Kennecott Copper Corporation** in Garfield, Utah, a 10-by 16-foot Marcy rod mill has been put into operation on a test basis. If satisfactory results are obtained in the trial period of about a year, the company will probably replace present crushing rolls with rod mills. The test mill has been installed in the concentrator circuit between earlier crushing operations and the fine grinding step, presently handling about 3,700 tons of ore daily. The rod mill uses steel rods of three-inch diameter in its process to grind the coarse copper ore received from the company's **Bingham Canyon,** Utah, mine.

# Wyoming

Drilling in the Shirley Basin southeast of the Gas Hills area in Wyoming has uncovered what appears to be a major ore body between 100 and 150 feet deep that can be mined by open pit methods, according to Cotter Ferguson, president of **Gas Hills Uranium Company.** At the Riverton, Wyoming, uranium processing mill of **Federal-Radorock-Gas Hills Partners,** a $180,000 modification program under way will boost capacity from 529 to 800 tons a day. The mill, located near the Natron-Fremont County line in the Gas Hills area, began operations about a year ago. According to Ferguson, the modification program should make it possible for the partnership to make up production of yellow cake during the fiscal year so the full $529,000 a month in sales authorized by an AEC contract can be made.

Production from uranium mining operations of **Hidden Splendor Mining Company** in Utah, Wyoming, and New Mexico during the first half of this year totalled about 285,000 tons.

**Petrotomics, Inc.,** is expected to build Wyoming's sixth uranium mill as a result of its recent contract with the Atomic Energy Commission for purchase of sizeable quantities of ore produced in the Shirely Basin area. Petrotomics, with principal offices in Oklahoma City, is a partnership comprising **Kerr-McGee Oil Industries, Inc., Tidewater Oil Company, Skelly Oil Company,** and **Getty Oil Company.** The AEC contract also provides that Petrotomics may, at its option, build a mill for production of the $U_3O_8$ covered by the purchase agreement in the 1962 to 1966 period or make arrangements with present mills for such recovery. In either event, a flat $8.00 a pound price, without amortization, will be paid by the Commission for concentrates produced after April 1, 1962. The amount the AEC will purchase between now and December 31, 1966 is reportedly between 3,500,000 and 3,700,000 pounds. Of this amount about 500,000 pounds of uranium oxide in ore will be delivered to the AEC stockpile in Shirley Basin. The AEC has not yet allocated purchasable pounds from Shirley Basin to a venture in which **Federal Resources, Inc., Hidden Splendor Mining Company** and **Gas Hills Uranium Company** are involved. **Utah Construction and Mining Company** which has acquired the **Sasso-Simmons** ore body in Shirley Basin has not yet received a contract either.


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## Search for New Iron Sources Continues in Southwest

Exploration for near-Pacific-coast sources of iron ore continues at an accelerated pace. Iron markets will continue to grow. Large export shipments of iron ore continue from southern California and central Nevada to Japan. There is the growing possibility too that a major blast furnace plant will be added to existing San Francisco Bay area steel mills and will of course need iron ore.

Those airplanes you see flying back and forth along parallel flight lines in Nevada, and California's Mojave desert region are probably looking for iron ores with a magnetometer.

Those Nevada diamond drills you see east of Carson City, southeast of Yerington, and in the Buena Vista Hills district south of Lovelock are all drilling for iron ore.

Utah Construction and Mining Company has been drilling east of Carson City for several months and has indicated reserves of several millions of tons. Columbia Geneva division of United States Steel Corporation has reportedly added many tens of millions of tons of reserves to those already known in the Buena Vista Hills. (See MINING WORLD, March 1960, pages 26 through 31). Columbia Geneva is also drilling what must be a magnetic anomaly near Yerington. Results are not known within the industry. Drills at work north and east of the Buena Vista Hills are reportedly financed by a private group of investors.

In Rio Arriba County, New Mexico, Inland Steel Company has staked claims covering a large area where magnetic taconite, similar in many respects to eastern Mesabi Range taconite, crops out. Mineralization is extensive with channel samples assaying 35 percent iron over 35 foot widths.

Cleveland-Cliffs Iron Company has been drilling for magnetite in southern Idaho and New Mexico.

You can be certain that exploration will continue for iron, primarily for magnetite deposits because they're easier to find and beneficate.

## Kermac Anticipates Monthly Throughput of 100,000 Tons

Kermac Nuclear Fuels Corporation, Kerr-McGee subsidiary, reports that it had sufficient ore from controlled properties and custom producers by last April to operate its uranium mill for the first time in excess of its rated capacity of 110,000 tons a month. Kermac's 3,630-ton-per-day acid leach-solvent extraction plant in the Ambrosia Lake area of New Mexico is the country's largest uranium mill. The company's production of yellow cake is contracted to the AEC through 1966, with provision to make up underproduction prior to March 31, 1962.

Most recent exploration of Kermac properties in Ambrosia Lake by actual development and long hole drilling have proven that original ore reserve estimates were conservative both as to tonnage and grade. Anticipated milling throughput of 100,000 tons of ore per month available from six mines in the district is expected to be realized during the current fiscal year.

Kerr-McGee also owns 25 percent interest in Ambrosia Lake Uranium Corporation, which has extensive reserves in the Ambrosia Lake area and has dedicated its ore production to Kermac. Exploration on properties of the two firms indicate a 20-year reserve of uranium-bearing ore.

Kerr-McGee recently joined with Tidewater, Skelly and Getty oil companies to form Petrotomics Company for development of uranium deposits in Shirley Basin, Carbon County, Wyoming. The new firm has an AEC contract which provides that Petrotomics may, at its option, build a mill for production of the $U_3O_8$ covered in the agreement.

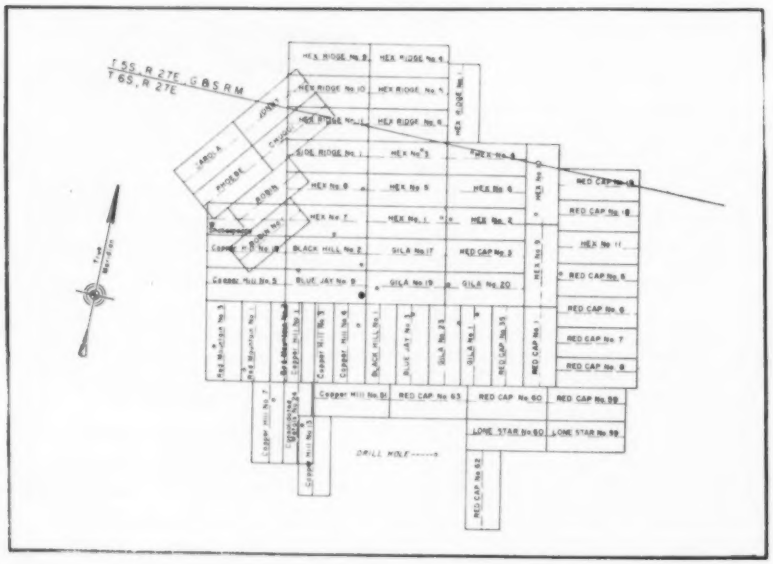
## Arizona AIME Plans Annual Meeting December 5 in Tucson

December 5 is the date set by the Arizona Section of AIME for its annual meeting which will be held at the Pioneer Hotel in Tucson. Principal speaker will be R. R. McNaughton, president-elect of the national group. C. W. Lawson of Douglas is the Arizona section chairman and J. D. Forrester, Dean of the College of Mines at the University of Arizona, is in charge of arrangements. Business and technical sessions will be held by divisions in the afternoon and the formal business meeting will take place in the evening.

# Arizona

**The Hi Jolly Mines Corporation** has contracted with the **G. R. Haynes Company** of Kingman, Arizona, for approximately $3,000 worth of road construction. The new 14-foot road is being built from the bottom of Clack Canyon to the site

## Kennecott Patent Applications Near Safford, Arizona




Applications for mineral patent made by Kennecott Copper Corporation in the Safford, Arizona, area recently cover 53 claims encompassing 1,011.108 acres in the Lone Star Mining District of Graham County. Kennecott is planning to sink a shaft in the Safford area where some 120 claims were purchased in 1959 for approximately $4,000,000.

The claims included in the firm's recent patent application are: The Lone Wolf Nos. 1, 2 and 3, and the Iron Cap Numbers One, Two and Three lodes, totalling 121.330 acres; Consolidated Metals Nos. 24 lode, 20.288 acres; Red Mountain Nos. 1, 2 and 3 lodes, 55.96 acres; Copper Hill No. 7 lode, 20.625 acres; Red Cap Nos. 1, 3, 5, 6, 7, 8, 18, 19, 35, 59, 60, 62 and 63 lodes; Lone Star Nos. 59 and 60; Blue Jay Nos. 3 and 9; Gila Nos. 1, 17, 19, 20, and 23; Hex Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 lodes; Black Hill Nos. 1 and 2; Copper Hill Nos. 1, 3, 13, 4, 5, 16 and 51. This last group amounts to 792.908 acres.

The map here shows the claim boundaries with township and section lines where available. It is believed to be accurate, since it was compiled from information on file with the Graham County, Arizona, recorder's office.

Mineral Survey No. 4455 (Arizona) is known to cover the following claims: Iron Cap Nos. 1, 2, and 3, and the Lone Wolf Nos. 1, 2, and 3 which are staked to cover the ground at the south end of the map between the Copper Hill No. 13 and the Lone Star No. 60 and the Red Cap No. 62 claims. The claims are staked at an angle to the Copper Hill No. 13.

Mineral Survey No. 4457 (Arizona) covers the Red Cap, Lone Star, Blue Jay, Gila, Hex, Black Hill, and Copper Hill lode claims. Copper Hill No. 7 is covered by Mineral Survey No. 4475. Mineral Survey No. 4454 is for the Consolidated Metals No. 24 lode, and No. 4453 for the Red Mountain lodes.

In early September Mineral Survey No. 4456 was made of the Hex Ridge Nos. 1, 5, 10, 4, 6, 9, and 11; the Side Ridge No. 1, Johnny, Chuqui, Phoebe, Carola, Robin, Robin No. 1, and W. Shakespear lodes. It is not known if there is any pending patent application.

Kennecott has also staked and/or purchased, and surveyed several other claims but has not applied for patents on these.

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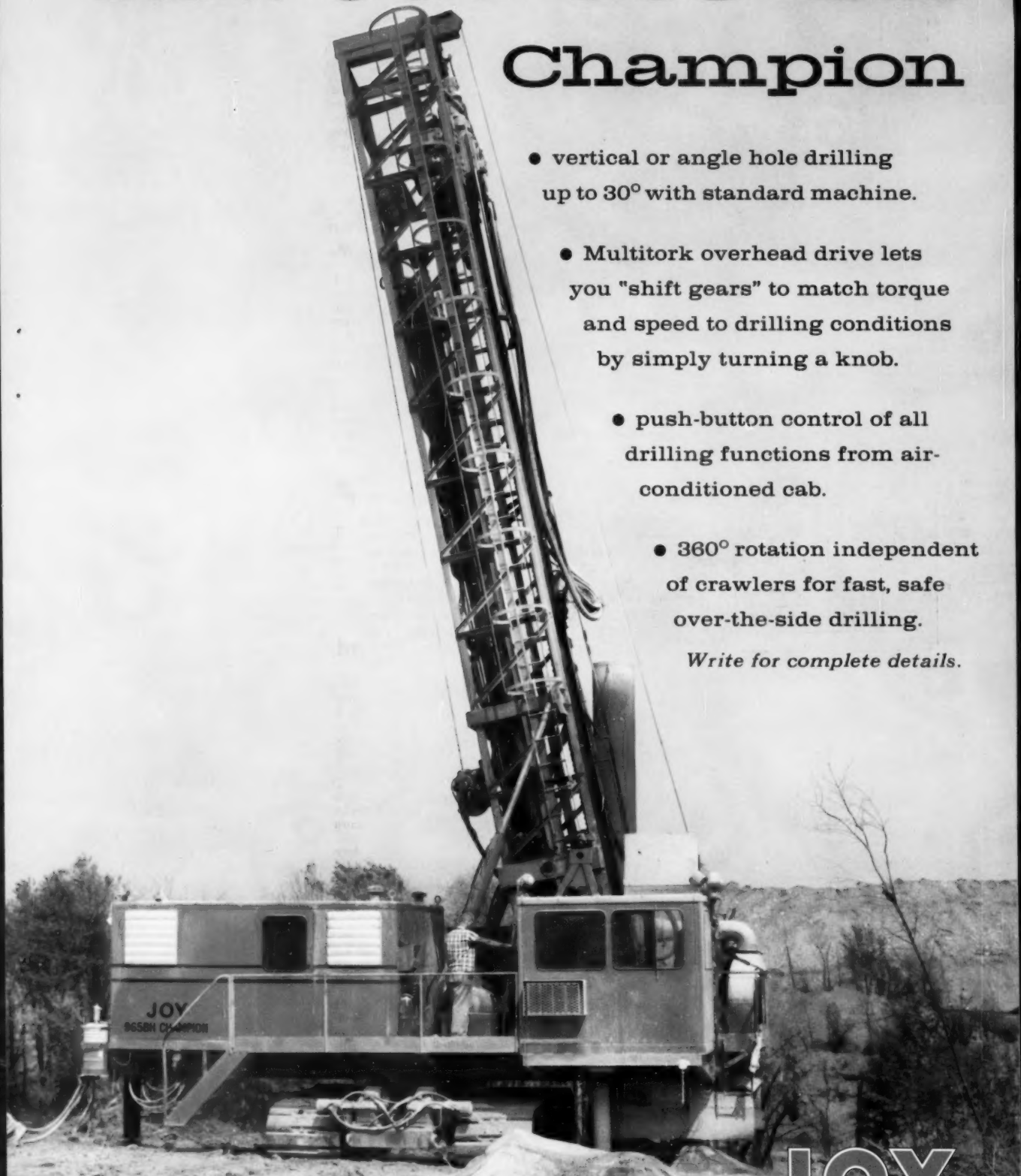


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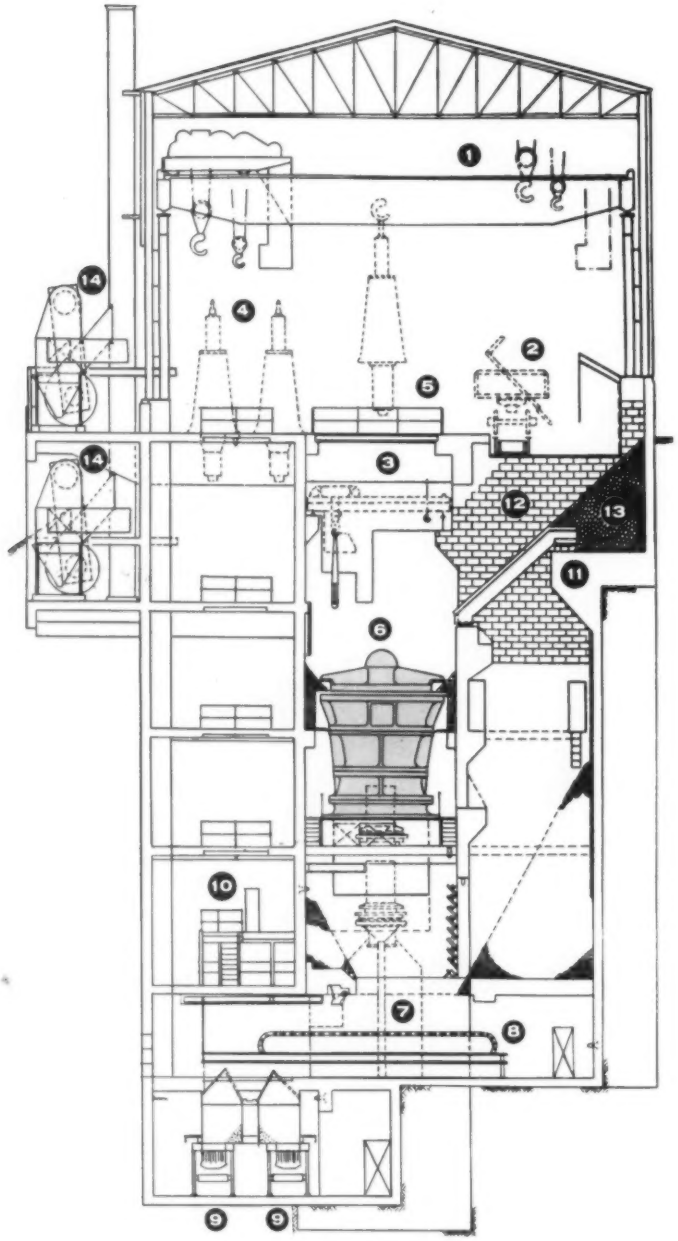

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selected for construction of an ore bin at the **Rico-Noon** mine, a distance of about three-quarters of a mile. According to W. E. Iseman of Tucson, president, as soon as essential rehabilitation work at the Rico can be completed, the company expects to install production equipment. A contract for $18,000 has been awarded to the **Thatcher Drilling Company** of Tucson, Arizona, for diamond core drilling the Rico-Noon property, Mr. Wiseman reports. As well as its lease-purchase agreements covering the Rico-Noon and **White Eagle** properties in Mohave County, Hi Jolly is interested in the Copper Peak, La Chacha and Tucson groups of claims in Yuma County.

**B. S. & K. Mining Company** is producing regularly from its **Atlas** mine in the Silver Bell district of Pima County, Arizona, mining and milling slightly over 2,000 tons of zinc-copper ore monthly. Concentrates are hauled by truck to the loading ramp at Red Rock, then shipped by rail. The zinc concentrates go to the **Eagle-Picher** zinc smelter at Henryetta, Oklahoma, and the copper concentrates to the **Asarco** smelter at El Paso, Texas. The company is said to be planning for a new shaft in the near future, but the exact location has not been determined. Considerable diamond drilling, from both the surface and underground, is in progress for regular exploration and development work, and to assist in determining the location of the new shaft. Walter Whitlow of Silver Bell, is mine manager, employing a crew of 21 men—15 in the mine and 6 in the mill. A. M. Kalaf, of Phoenix, is company president.

Expansion of the **Morenci,** Arizona, open-pit mine to the south has made it necessary for **Phelps-Dodge Corporation** to relocate all plant facilities used in that mining operation. A new south side railroad switchback system is also being constructed in connection with the expansion. When the relocation and construction are completed in 1961, 18 buildings with their allied equipment will have been moved. The new locomotive shop will have complete facilities for repair and maintenance of Diesel locomotives, including 17 electric Diesels of 1,750 horsepower. The change room provides shower and change facilities for 1,000 men; the mine supply warehouse has 15,400 square feet of usable floor space.

**The Jaquays Mining Corporation,** Globe, Arizona, is operating both the **Chrysotile** and **Regal** asbestos mines, treating the ore in its new fiberizing plant. The company has already delivered to the government stockpile 120 tons of its 450-ton contract for Grade No. 2 chrysotile asbestos, and is producing five other grades for the general market. D. W. Jaquays is president and general manager of the company.

# California

**Cog Minerals Corporation** of Williams, California, has received an OME contract for $35,060. Cog operates the **Abbott** mercury mine and mill near Williams.

**Kern County Land Company** has reportedly bid $100,000 for **Borax No. 1** and **No. 2** miles in Death Valley, Inyo County, California. The properties, comprising 36 acres, are those of **U. S. Borax and Chemical Company** which in 1945 entered a consent decree to divest itself of them under an anti-trust action. The land company has been purchasing land in the area for the last four years and also has been engaged in a drilling program in its extensive Mojave Desert property where substantial calcium borate deposits have been located.

# Nevada

Current exploration for new copper sources by **Bear Creek Mining Company** in the Lane City area of White Pine County, Nevada, includes a core drilling program by **Sprague & Henwood Drilling Company.** Bear Creek is the exploration subsidiary of **Kennecott Copper Corporation** which operates extensively in White Pine County through its **Nevada Mines Division.**

**Newmont Exploration Ltd.** is surface drilling in an exploration program for lead, zinc, and copper in the Spruce Mountain district, 50 miles south of Wells, Nevada, where it leased the **Spruce Mountain** mine. M. H. White is the engineer in charge, and **Boyles Brothers Drilling Company** has the drilling contract.

**Leprechaun Mining and Chemical, Inc.** of Las Vegas, Nevada, has contracted with the **E. J. Longyear Company** of Minneapolis, Minnesota, for a drilling program at its **Silver Peak** alkali project. The first hole was started in late August for exploration of salines in Clayton Valley. Tests to 1,500 foot depth are planned. A geophysical study earlier indicated a basin 3,000 feet deep and the Leprechaun geologists expect borax, potash, and other commercial salts to be discovered. Longyear is using a drill rig that has a wire line system in which cores are extracted through the rod without removing the bit from the drill hole. C. P. Keegel is president of Leprechaun, Roy Black is process consultant, and Bob Campbell directs geological phases.

**Apex Minerals Corporation** is currently shipping from its Austin, Nevada, uranium operations ore that averages in excess of 0.2 percent $U_3O_8$. Scheduled shipments, to **Vitro Minerals Corporation** at Salt Lake City, Utah, are at the rate of 50 tons a day. Underground development work has shown a continuation of the coffenite ore body below the H-winze. Crosscutting has begun on the main shaft level to intersect this ore on its dip to the northwest. The company believes this to be the main zone of enrichment continuing downward.

The Office of Mineral Exploration has approved a $20,660 lead-zinc-copper exploration project in Esmeralda County, Nevada, by **Gold Eagle Mines Inc.** of Longview, Washington.

**Continental Materials Corporation** of Chicago, Illinois, which has acquired half the common stock of **Yale Gold Mining Company** of Elko County, Nevada, will invest $100,000 in exploration and development of a silver-gold property located two miles north of Midas, Nevada. Yale has been exploring on the **Elko Prince** and old **Miners Gold** property for the last year, and recently cut a vein of ore 1,000 feet from the old gold quartz deposit in the **Yale Prince** mine. This cross-cut from the Miners Gold tunnel will be explored as a result of Continental's participation in the project. A subsidiary of **New Park Mining** and **East Utah Mining** companies, Yale was formed in 1957 to reopen the Elko Prince mine which is located about 50 miles north of Elko.

**Mercie Mining & Holding Company** of Visalia, California, has undertaken a development program at the **Atlaslode** gold-silver-lead mine northwest of Winnemucca, Nevada. Capt. Carl J. Buehler, president, also reports that the company has acquired property containing an oxide copper deposit. The firm is staking about 100 claims to cover the area.

# New Mexico

Production by **Potash Company of America** at Carlsbad, New Mexico, was increased some 7 per cent during the fiscal year just ended. Engineer reports indicate potash reserves there are adequate to continue production at this level at least through the next decade. Sales of the company's six potash products were higher this year than in any other. Sales contracts for the current year are equal to total estimated production, with prices higher than the past year.

The north area of the **Hogan** mine in Ambrosia Lake, New Mexico, was closed in August following two recent fatal mine accidents. The mine is operated by the **Four Corners Exploration Company.** According to William Hays, state mine inspector, there were not enough supports in the mine, and additional square-set timbering will be needed, as well as properly supported access ways to certain mining equipment.

**Kerr McGee Oil Industries Inc.** is now recovering vanadium as a by-product at its Shiprock, New Mexico, uranium processing plant, and selling it to steel producers throughout the world. The company is steadily increasing its interest in mining and mineral exploration. Exploration offices have been established by Kerr-McGee in Casper, Wyoming; Craig and Golden, Colorado; Albuquerque, Shiprock, and Grants, New Mexico; Charlotte, North Carolina, and Poteau, Oklahoma.

**Kennecott Copper Corporation's** Chino, New Mexico, Mines Division set a new safety record August 24 when the mill extended its accident-free operation to 600 days. During this period the mill operated for more than 500,000 man-hours without a lost-time injury. Average employment at the mill in the period was 224 men.

# Texas

Start of operations at a $500,000 barite processing plant in Houston, Texas, is scheduled for mid-November. The highly automated plant, employing only about 15 persons, is being built by **International Minerals & Chemical Corporation.** The plant will grind and bag barite, with ore acquired domestically from Missouri and imported from Mexico, Peru, and the Mediterranean area. George Brunner, formerly with IMC's chemical plant at Niagara Falls, is plant manager, and Charles Loucks, general production manager.

## Glacier Peak Copper Property Included in Wilderness Area

The promising Glacier Peak copper property in eastern Snohomish County has been included in the new Glacier Peak Wilderness Area designated recently by Secretary of Agriculture Ezra Taft Benson. This is the property on which Bear Creek Mining Company, exploration subsidiary of Kennecott Copper Corporation, has spent several hundred thousand dollars in the last several years. Crews, drilling equipment and supplies were air-lifted to the property by helicopter and drilling proved-up large ore reserves.

The Portland office of the United States Forest Service had proposed to exclude the property from the wilderness area. An agricultural department official announced that certain mining and prospecting would be permitted in the area but that lumbering and other commercial development will be prohibited. Washington mining men have expressed concern lest prospectors be shut out of the high, remote areas of the northern Cascade mountains which geologists consider promising for the discovery of such strategic minerals as beryllium.

R. D. Hutchinson, northwest district geologist for Bear Creek, points out that this designation of the property, although it provides for mineral entry, in effect withdraws the area from prospecting by modern methods because mechanical transport will be banned in the new wilderness except for access to valid mining claims. Since the only effective way to prospect in this rugged, remote area is by helicopter transport, Mr. Hutchinson predicts it will be a long time before any more mineral exploration is done in this geologically interesting area.

# Alaska

Proposed state mining regulations will be the subject of public hearings in five Alaskan cities during November, conducted by the Division of Lands and the Division of Mines and Minerals. Regulations will provide for manner of staking and holding claims on lands where claim staking is allowed, and for mining leasing procedures and rentals on land so classified that mineral rights must be leased. Mining leasing on tide and submerged lands will also be covered. The regulations will affect only state-owned lands, not federal, but to avoid confussion will be similar to federal requirements where possible. They will not apply to coal-mining nor other so-called "leasable minerals." Copies of the proposed regulations may be obtained by request from the Division of Mines and Minerals at Box 1391, Juneau, or the Division of Lands at 340 Sixth Avenue, Anchorage. Written comments should be sent to the former division. Hearings are scheduled as follows: Ketchikan, Nov. 7, 9:30 a.m., in Council Chamber, City Hall; Juneau, Nov. 8, 2 p.m., Room 218, Municipal Building; Fairbanks, Nov. 14, 9 a.m., Traveler's Inn; Nome, Nov. 16, 9:30 a.m., Court Room, Court House, and Anchorage, Nov. 18, 9:30 a.m., Loussac Library.

Tunnelling through ice of Texas Creek Glacier near Hyder, Alaska was completed to a length of 350 feet this summer by **Alaska State Mines,** in a search for a deposit of electrum under the glacier. Electrum was discovered in 1925 as float at the foot of the glacier and the lode in place mined on a small scale in 1937. Specimens from the deposit contain up to 3,460 ounces of gold per ton.

Lenhart J. Grothe of Red Devil, Alaska bid $21,777 for property at the **Lost River Tin** mine on Seward Peninsula offered for sale in August by General Services Administration.

Mining operations have been deferred until next spring by **JOT Mining Company** which had planned to mine and ship uranium this summer from the **Kendrick Bay Mining Company** pit and adjacent claims at Bokan Mountain.

At Funter Bay, Alaska, **Admiralty Alaska Gold Mining Company** is drifting on the 200 level toward the copper-nickel Mertie lode. The drift has been advanced to a depth of slightly more than 5,000 feet, penetrating a broad zone of disseminated pyrite and pyrrhotite. The face of the drift is approaching the end of a diamond drill hole which was stopped by a large flow of water.

# Idaho

**Zontelli Brothers** iron mining company based in Ironton, Minnesota, has continued its diamond drill exploration program near Potlatch, Idaho, where it is investigating a magnetite iron ore prospect optioned from the **R. M. Adams Company** of Duluth, Minnesota. Martin Torgerson is handling the drilling program under direction of S. S. Thurmond, Jr.

**Beryllium International Inc.,** of Washington, D. C., has acquired an option on the 13 original discovery claims of Kenneth Liddiard, who made the recent beryllium discovery in the Sawtooth Mountain area of south central Idaho. A project to determine the extent of the discovery is being started immediately. (See MINING WORLD October 1960, page 91). Beryllium International, comprising mainly Washington interests, is headed by Charles R. Rudolph.

A new exploration venture has been started in the Osburn section of the Silver Belt, Coeur d'Alene mining region, in Idaho. **Coeur d'Alene Consolidated Silver-Lead Mines, Inc.,** is reopening a shallow tunnel driven by hand labor many years ago on the Freeman & Sites group of claims up McFarren gulch to investigate the source of galena ore on the old dump. An exploratory winze may be sunk on the vein, if it is sufficiently promising. J. A. Allen, of Spokane, Washington, is president.

Construction of a 750-foot tramway is planned by **Selkirk Mining Company** at its **Plowboy** mine north of Priest Lake, Bonner County, Idaho. The tram will move lead-silver ore from a surface outcrop stripping operation to a stockpile area at a lower elevation. High-grade ore will be trucked to a smelter and milling-grade trucked to a concentrator. A test shipment was sent to the East Helena, Montana, smelter. The silver-lead property is owned by Kenneth Bagdon and Carl Martinson of Spokane, Washington and Rowland Stokes, San Diego, California.

**South Fork Mining and Leasing Company** is being dissolved and assets totaling about $13,000 in cash will be distributed to some 200 stockholders. W. F. Hofstetter, of Spokane, is secretary-treasurer of the firm which carried on gold dredging near Elk City, Idaho a number of years ago.

Checks totaling $413,250 were mailed recently to 800 former shareholders of **Northwest Uranium Mines, Inc.,** as an initial distribution from **Silver Buckle Mining Company,** Wallace, Idaho, which took over development of Northwest's uranium properties in the Spokane Indian Reservation and recently sold them to **Dawn Mining Company** for $1,000,000. Jack D. Gay, Wallace, is trustee for the shareholders.

**Bunker Chance Mining Company** has started annual assessment work at its mining claims at Wardner, Shoshone County, Idaho, raising the money through an assessment of 1.0 cent a share. M. M. Lucas, Kellogg, is secretary-treasurer.

**Sunshine Mining Company** is cutting a station for its No. 10 shaft at a new site on the bottom 4,000-foot level of its mine workings in the Silver Belt of the Coeur d'Alene mining region between Wallace and Kellogg, Idaho. The site was changed because of unfavorable ground conditions. Sinking of the 400-foot shaft will be started after a raise is driven through to the 3,700-foot level and hoisting machinery installed. John Edgar is manager of the firm's division of mines.

**Idaho Mining & Milling Company** of Lewiston, Idaho, has purchased a dredge which it will use in gold dredging in the Florence Basin, Idaho County. The 200-ton-plus dredge is being moved from Warren, Idaho, where it has been used recovering monazite.

Increased output from phosphate producers in Utah, Idaho, and Wyoming during the last two years is expected to be even larger in the next year. Four principal producers—**J. R. Simplot Company, Monsanto Chemical Company, Central Farmers Fertilizer Company,** and **San Francisco Chemical Company** are producing about 100,000 tons of ore daily in Idaho alone. The last two years has seen a 3.5 percent increase in phosphate mining, and a further 5.0 percent increase is expected this year.

**Salmon River Scheelite Corporation** at last report was seeking a market for tungsten concentrates. The **Office of Minerals Exploration** recently certified that the firm's property near Salmon, Idaho, is a commercial scheelite mine. Exploration work under a contract authorized by the predecessor DMEA was completed last November and showed a substantial body of high grade ore and larger bodies of milling-grade ore. Frank A. Taft, Salt Lake City, Utah, is general manager and vice president; James E. Clutis, Salmon, secretary-treasurer, and Harvey Penney, Salt Lake City, president.

Some 5,000,000 cubic yards of overburden have been stripped to date to uncover phosphate deposits near Soda Springs, Idaho to supply the plant of **Monsanto Chemical Company. Morrison-Knudsen Company Inc.** has the contract which covers hauling and stockpiling the ore, as well as strip-mining and loading from deposits with an elevation as high as 7,000 feet. Another phase of the work includes quarrying and crushing quartzite, which Monsanto uses as a flux.

## WHAT'S GOING ON...
### NORTHWEST

Scrapers and dozers are used in the mining operation and ore is loaded into 22-cubic-yard end-dump trucks for transfer to a nearby twin loading tipple. Then giant bottom-dump hauling units, so big their operators choose to call them "trains," make final delivery to plant stockpiles. The ore trucks are nearly 105 feet long, gross better than 200,000 pounds, and haul a 72-ton payload at 50 miles per hour. High elevation and severe winters restrict mining and hauling activities to a five month season, but enough ore is produced and stockpiled to run the Monsanto plant the year round.

Repair of the mine ventilation system and replacement of a lightning-damaged electric motor were among projects undertaken by **General Mines Corporation** recently at its property in the Pine Creek district of the Coeur d'Alene Mining region, Shoshone County, Idaho. H. G. Loop, Spokane, is president.

A new hoist motor and controls are being installed at the **Conjecture** silver mine at the southern tip of Lake Pend Oreille, Bonner County, Idaho preparatory to deepening the present 1,000-foot shaft to the 2,000-foot point. The property is being developed for production by **Federal Uranium Corporation** of Salt Lake City, Utah. It is owned by **Conjecture Mines, Inc.**, Spokane, headed by Donald E. Majer. Miners have completed a diamond drilling program on the 1,000-foot level and raised through to the old 700-foot workings developed from an inclined shaft.

# Montana

**Webb and Knapp Company** has announced that satisfactory progress is being made in rail rate schedules to transport steel products from Anaconda, Montana, to markets on the Pacific Coast. The firm some time ago announced plans to build a $40,000,000 steel mill at Anaconda using smelter slag as a source of iron ore.

At the **Nancy Lee** mine near Superior, Mineral County, Montana, a silver-lead ore body has been developed over a strike length of more than 210 feet and an average width of 16 feet. Concentrates made in the Nancy Lee mill are being shipped to the Selby smelter of **American Smelting and Refining Company** in California.

Development work is getting underway at the old **Meadow Mountain** adit near Saltese, Mineral County, Montana. The tunnel has been rehabilitated by **Mineral King Mining Company**, headed by Charles F. Buls, Missoula.

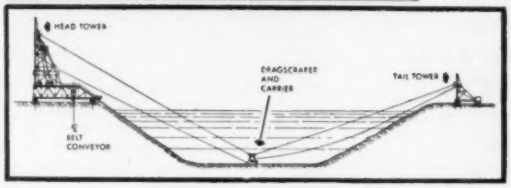
**The Ruby Gulch Mining Company** is continuing prospecting the old **Ruby Gulch** and **Alabama** gold mines near Zortman, Montana. The company is presently driving a cross-cut to intersect an extension of one of the ore bearing structures. This mine has been a large producer in the past.

Testing of its enlarged and remodelled cyanide mill at Bannack, Montana was begun in September by **Spokane National**


# Tough Digging, Long Hauls... Routine Jobs for Sauerman DragScrapers

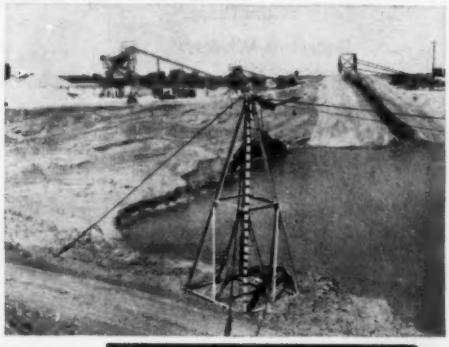
**240-Ft. Bank... 350-Ft. Haul**

This mobile Sauerman Tower Excavator digs 480 yds. per hr. on an average haul of 350 ft. from a high bank to a portable field hopper. The 12-yd. Crescent DragScraper operates between steel head and tail towers. The towers are mounted on two sets of railroad tracks and ride on four sets of trucks. DragScraper power is supplied by two hoists mounted on the head tower. One hoist operates the load and pull-back cables, the other is used to tension the track cable. The hoists are controlled by one operator located in the cab on the tower. The load cable handles over 400,000 tons of material before replacement.




*Drawing shows typical mobile tower excavator digging in wet pit.*

**75 Ft. Under Water... 800-Ft. Span**



A 5-yd. rapid-shifting DragScraper supplies about 200 yds. per hr. to the plant hopper in background. Bridle tower in foreground is one of two supporting the bridle shifting cable which is controlled by the third drum of the Sauerman hoist. Lateral shifting of the DragScraper's line of operation is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The DragScraper is digging 75 ft. under water and the operating span is 800 ft. from head frame to the bridle towers. Over a million tons have been excavated from this pit. The DragScraper often operates 24 hrs. a day to handle contract demands.

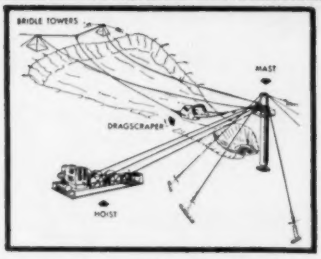



*Diagram shows details of Sauerman rapid-shifting DragScraper.*

Sauerman machines dig and haul in one continuous operation . . . work on high bank, dry pit or under water . . . handle most bulk materials. Consult Sauerman engineers about your job. We will promptly supply appropriate literature.

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Timken Bearings

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Available in 6" and 8" sizes. Note extra wide throat. Ruggedly built for carrying tail ropes. Sheave units are of solid construction with no flanges. 6WT sheave is alloy steel; 8WT is manganese.

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## WHAT'S GOING ON...

### NORTHWEST

**Mines, Inc.** The mill has been enlarged from 50 to 150 tons per day and flotation cells have been added for handling silver, lead, zinc, and copper ores from the **New Departure** mine, 16 miles from Dillon, Montana. The mill formerly handled gold ore from the **Hendricks** mine. A new road has been completed; ore haulage is about 8 miles. Spokane National has completed stripping over 150,000 cubic yards from Pit No. 3 where mill feed of approximately 28 ounces has been developed. Enough ore has been opened for continuous mill operation for over a year. From 200 to 250 tons of ore will be trucked daily to the mill for the rest of the year. Underground mining will be pushed during the winter and the company plans direct shipments to the smelter of known high grade ores. Overall mining and milling is under supervision of G. H. Allison, president. Earl H. Brooks is mill superintendent.

**The Anaconda Company** has withdrawn its petition for abandonment of the Meaderville road near Butte, Montana, and will start preparing its own ground east of the roadway for open-pit mining operations. Residents of Meaderville were opposed to having a substitute roadway because of its adverse effect on transaction of business and value of property. Anaconda Company wanted the road to be abandoned to permit a gradual systematic expansion of the Berkeley pit over a period of many years, and had offered to build a new roadway connecting Meaderville with the Butte-Helena highway. Now it will prepare ground east of the present road for future open pit mining, including engineering plans for moving the channel of Silver Bow Creek farther to the east.

## Oregon

A. O. Bartell, Portland, Oregon is undertaking exploration of a mercury deposit at the **Nisbet** mine, Clackamas County, Oregon. The United States Office of Minerals Exploration has approved $14,290 worth of drilling. Government participation will be 50 per cent.

At the **Ibex** gold mine, Cracker Creek district, Baker County, Oregon, **Regal Mining Company,** Vancouver, British Columbia, continues to reopen and sample old workings.

Placer ground six miles north of Halfway, Baker County, Oregon is being tested by cutting trenches to bedrock about 65 feet below the surface. Equipment includes a slack line cableway and slusher powered by a double drum diesel hoist and a sluiceway setup. The McDonald brothers are doing the work.

On Cave Creek, Baker County, Oregon, Robert Hulin has opened cinnabar showings on nine claims along a fault zone in Burnt River schists. He made his original mercury discovery early last year.

Two new technical publications released by the Department of the Interior describe studies that culminated in experimental production of high-purity chromium and yttrium metals by scientists at the **U. S. Bureau of Mines,** in Albany, Oregon. The report on high-purity chromium by electrolysis, written by P. C. Good, D. H. Yee, and F. E. Block, discusses experiments in which chromium metal was deposited in ultrapure form by passing an electric current through a hot solution of chromium trioxide. The study contributed to the Bureau's production of ductile chromium wire which in irradiated form has been hailed as a promising weapon against cancer. The publication about preparation of high-purity yttrium by metallic reduction of yttrium trichloride describes how yttrium trichloride was reduced to extremely pure metal by reacting it with hot lithium or sodium metal in a crucible filled with inert gas.

## Washington

The exploration group of **Bear Creek Mining Company** investigating copper possibilities in and around Snohomish County, Washington, recently, is headed by R. S. Werner, with Frank Greene and Ole Erickson among the geologists. The team's equipment includes a small portable core drill and a three-passenger helicopter for flying men into remote areas otherwise accessible only by several day's walking.

A report on mineral resources in the Colville Indian Reservation is being prepared by Donald J. P. Lyon of the Stanford Research Institute as part of an economic study which will serve as a basis for a legislative program designed to terminate federal supervision and develop tribal lands.

Construction of a 50-ton gravity concentrator is planned at the site of a tungsten development near the old Spokane tin mine on Silver Hill, five miles south of Spokane, Washington. A shaker-screen installation at the site has provided fine ore which has been concentrated into a commercial product at a pilot jig plant in Spokane. Intermittent stripping operations in the last two years have exposed numerous tungsten veins up to 10 feet in width in a mineralized zone about 500 feet wide and 2,000 feet long. Both scheelite and wolframite are present, along with tin values. **Daybreak Uranium, Inc.,** of Opportunity, Washington, has acquired a 10 percent interest in the tungsten-tin property and has an option to acquire an additional 10 percent. Carl A. Coon is principal owner and operator. Robert N. Robey, Spokane. is consulting engineer.

A report on the Washington Department of Conservation geophysical survey for iron ore and other mineral deposits in northwestern Ferry County and northeastern Okanogan county was released in July. The five combined aeromagnetic and radiometric maps in the report cover an area of some 935 square miles, comprising the Mt. Bonaparte, Bodie Mountain, Curlew, Aeneas and Republic topographic quadrangle sheets. Coverage extends from the Canadian border to about 10 miles south of Republic, and from Molson on the west to Danville on the east. Data includes airborne recordings of the total intensity of the earth's magnetic field and radiometric scintillometer recordings. Copies of the report and maps may be purchased at the Department of Conservation, 335 General Administration, Olympia, Washington. Price is $1.50 and payment must accompany mail orders.

### Bureau of Mines Studies Nickel, Cobalt, Chromium

Recovery of nickel, cobalt, and chromium will be a principal subject of study by the U. S. Bureau of Mines during the current fiscal year.

Development of processes for recovering nickel and cobalt from high-temperature alloy scrap and for obtaining high-purity nickel and cobalt from laterite ores will be undertaken at Bureau research centers in Salt Lake City, Utah; College Park, Maryland, and Minneapolis, Minnesota. At the Bureau's Albany, Oregon metallurgy research center, scientists are investigating physical and chemical properties of a series of complex nickel-cobalt compounds in order to develop a new method for separating the two metals.

Another project at Albany will deal with recovery of chromium from low-grade domestic materials. The project is aimed at finding an economical flotation method for producing usable chromite concentrate from materials of the Stillwater Complex in Montana that are below the present ore cutoff grade. In the Bureau's Boulder City, Nevada, laboratory, methods for producing chromium or ferrochromium from sub-grade materials will be studied. Research is also underway to improve efficiency of pyrometallurgical techniques for recovering chromium.

## Central

**Aluminum Company of America** will close its chemical plant in East St. Louis, Illinois, where some 490 persons are employed. The shut-down will take place over an 18-month period starting early next year. Production will be transferred to more modern Alcoa facilities at Point Comfort, Texas, and Bauxite, Arkansas. The East St. Louis plant began as a bauxite refining plant in 1903 when its major source of ore was in Arkansas, and was Alcoa's sole source of alumina until 1938, when the Mobile, Alabama plant was built to process bauxite from Caribbean and South American deposits. Some 60 staff members of the East St. Louis branch of Alcoa Research Laboratories adjacent to the plant will continue in that location.

**St. Joseph Lead Company** is considering the possibility of a copper recovery program at its **Federal** mill, since there are several ore bodies in the area containing copper. The report that the company's Desloge mill would be reopened and converted to mill copper was denied by St. Joseph officials. Although such a matter was once under consideration, high cost of conversion and underground transportation of the ore make the plan impractical. If copper is found in the Viburnum area, it would be milled at that operation. St. Joseph's Leadwood mill is being converted to a lead-zinc mill.

Although consumption of fluorspar in the United States increased in the first quarter of this year, a lack of orders during the summer caused the **Ozark-Mahoning Mining Company** plant in Rosiclare, Illinois, to shut down for a period in August. During the first week in August the mill operated only four days. United States production of finished fluorspar in the first quarter totalled 46,500 tons, an 8 percent increase over 1959; shipments from domestic mines amounted to 49,000 tons compared to 40,600 tons last year. Fluorspar consumed in the first quarter of the year increased 17 percent. Crude fluorspar produced domestically totalled 109,400 short tons.

## Eastern

**The North Friend Station** zinc mine of **American Zinc Company of Tennessee** in Jefferson County, Tennessee, was closed down recently when all developed ore reserves were exhausted. The mine was the first mechanized mine in the East Tennessee district. American Zinc has also closed its **Grasselli** mine but continues to operate three other mines in the district.

R. O. Baum, president of **Tennessee Products and Chemical Corporation,** has announced that the company's Roane electric furnace plant in Rockwood, Tennessee will be either closed down or sold unless operations become more profitable. Iron ore for the furnace comes principally from the Birmingham, Alabama, district, where hematite is mined, and from local low-phosphorous limonite deposits.

In the Polk-Hillsborough county phosphate area of Florida, where two settling area dams broke earlier this year, engineers of all eight phosphate companies operating in the area have agreed on minimum design standards for dams to be built in the future. The new standards are based on proven engineering practices, advice from the U. S. Army Corps of Engineers, and other consultants.

**Davison Chemical Company** has ceased operations at its **Pauway No. 4** mine south of Lakeland, Florida, after nearly 40 years of continuous operation. Two draglines, the entire flotation section and other equipment will be moved to the company's **Bonny Lake** mine, where construction of expanded facilities will be completed this fall.

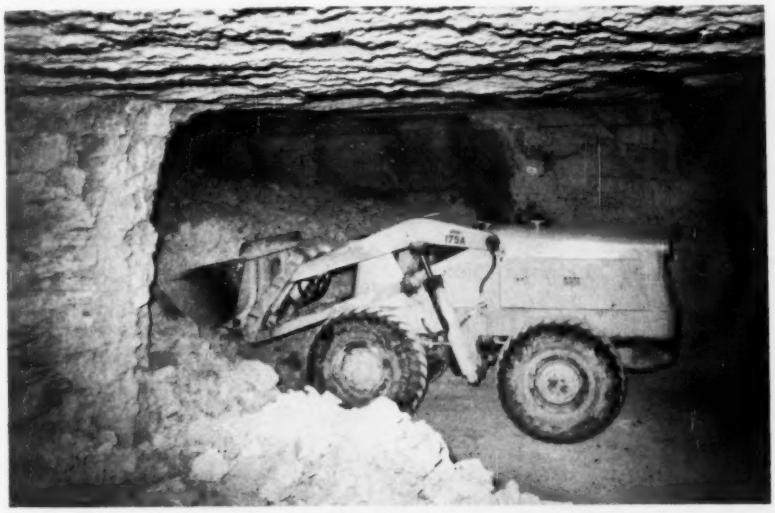
No signs of illness due to fluorine exposure were observed in employees of **American Cyanamid Company** engaged in phosphate operations at Brewster, Florida over a three-year period of observation and periodical examinations. A report on the study was given recently at the International Congress on Occupational Health.

At the **Craighead** and **Coates** fluorspar mine in Crittenden County, Kentucky, current work is concentrated on the block of ore above the 150-foot level. The mine is operating on two shifts and the washing plant on one. **Frazier Mining Company** in the same area is working a barite and fluorspar prospect on the old Commodore Fault. The company is operating from a shaft about 70 feet deep.

**Tri-State Metals Corporation** of Chester, West Virginia, has obtained approval of an OME contract to explore for beryl-tantalum in Taos County, New Mexico. Estimated cost is $25,360, with government participation of $12,680.

A symposium on automation was a highlight of the program when the Southeast Section, **AIME,** held its annual meeting Septemer 30 to October 1 at the Dinkler-Tutwiler Hotel in Birmingham, Alabama. First portion of the symposium was on "Remote Underground Dumping of Mine Cars by Industrial Television" and the second was "Automatic Loading of Railroad Coal Cars by Overhead Tripper." Other subjects discussed at the meeting included "The Selection of Supervisors and Their Role in Safety"; "Sinking the Cherokee Manshaft," and "The R-N Direct Reduction and Beneficiating Process of Iron Ore."

**The Carborundum Company** has begun operations at its new research facility in Niagara Falls, New York, for

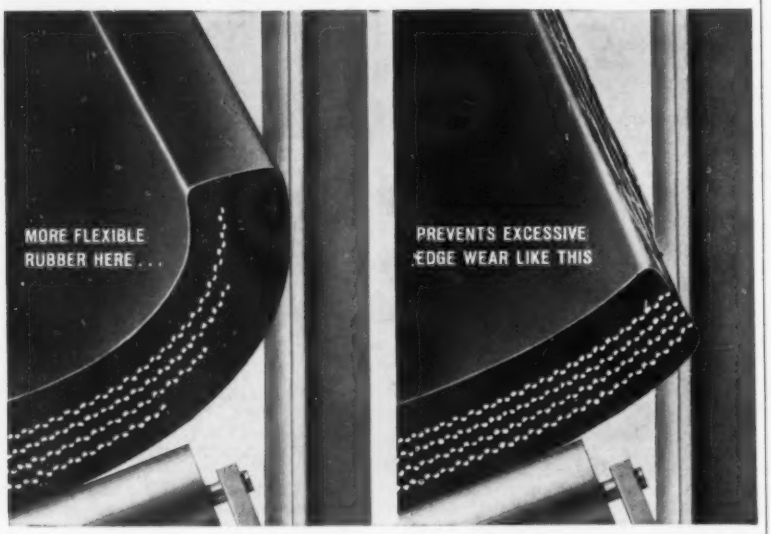


### Underground Lime Rock Mine Uses Front-End Loader

Kansas City Quarry Company uses a Michigan Model 175A rubber-tired front-end loader to load lime rock at its underground limestone mine near Kansas City, Missouri. Room-and-pillar mining is the method used in the all-Dieselized, off-track operation. In addition to loading rock, the front-end loader is used like a bulldozer to push broken fly-rock into the muck pile.

Quaker Thermoid

# "COLEDGE" BELTING REDUCES EDGE WEAR, ADDS MILES OF USE!




Improper training can ruin a conveyor belt faster than any other abuse. Riding up and rubbing against a frame member soon wears away the stiff edge of conventional belting and exposes the carcass plys to moisture, mildew, dirt and eventual ply separation. "Coledge" belt construction was developed by Thermoid Division—to overcome this weakness and extend belt life.

"Coledge" construction puts plenty of extra rubber on the edges where it counts . . . plys are stepped back to make a more flexible edge that rides with the punches when misalignment occurs. This "Coledge" construction is available in any standard type belt.

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work on the synthesis and fabrication of uranium carbide-plutonium carbide, a promising fuel combination for nuclear power reactors. Carborundum is a subcontractor to the **Nuclear Development Corporation of America** which holds a prime contract with the United States Atomic Energy Commission to conduct a complete study of this fuel. Lowering the cost of power from nuclear energy is the overall object of the program.

Maps of **St. Joseph Lead Company** properties in the Balmat, New York area have been prepared following an aerial survey of the area. The two-part project consisted of aerial photography using a precision mapping camera, followed by translation by stereophotogrammetric methods of the data and the photography into maps. Maps will be used for plotting extent of ore bodies and planning future core drillings.

## Iron Ranges

Of the 44,400,000 tons of iron ore shipped from the Lake Superior district during 1959, 32,500,000 or 73 percent was beneficiated. A breakdown of the processes and tonnage is: washed, 4,863,016; jigged, 293,115; heavy media, 4,099,434; other gravity, 2,376,628; magnetic, 5,943; flotation, 77,095; sized, 11,538,362, and agglomerates, 9,290,501 tons.

Five drills are presently being used by **U. S. Metals Refining Company** in a program begun last May north of Wakefield, Michigan. The company owns a large tract in the area where there is a formation similar to the copper formation in Ontonagon County to the east, U. S. Metals, an **American Metal Climax, Inc.** subsidiary, had previously drilled in the area and resumed the program this year.

A stripping program to extend the present pit area to the south is being carried out at the **Hill Annex** mine at Calumet, Minnesota, operated by the **Minnesota Ore Division** of **Jones & Laughlin Steel Corporation.** The tailings reclamation plant at the mine has been shut down for the season. The plant recovers iron by froth flotation from tailings of the Hill Annex-Arthur basin, with plant feed pumped from the basin by a hydraulic dredge.

On the Cuyuna iron range where mining is centered around Crosby, Minnesota, the **Pittsburgh Pacific Company** is operating the **Mangan, Joan, Sagamore,** and **Manuel-West Airport** mines. The company also operates the Virginia concentrator which serves company mines whose ores require upgrading before shipment. The **Coons-Pacific Company** custom ore treatment plant at Eveleth, Minnesota, handles ore from mines that do not have their own upgrading facilities.

Ore from the recently-opened **Nahman** mine near Eveleth, Minnesota, is being trucked one mile to the mill of **Edwards Mining & Milling Company,** formerly **Skubic Brothers Company. North Range Mining Company** of Negaunee, Michigan operates the new open-pit mine, which is an extension of the old **Leonidas** mine.

# INTERNATIONAL NEWS

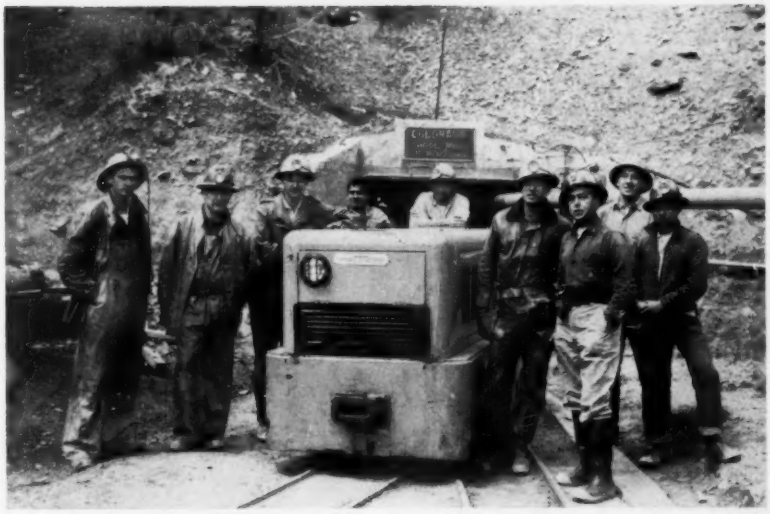
## Bear Creek Steps Up Drilling On Alaska Copper Prospect

An accelerated drilling program has been carried out recently at the Ruby Creek copper prospect in Alaska of Bear Creek Mining Company, which will continue its exploration in the area next year. During its fourth season of drilling and exploration on the property north of Kobuk, Bear Creek has employed a crew of about 45 men.

During the summer two drills were in operation most of the time, with a third arriving late in the season. Two other drills were scheduled for use, but low water on the Kobuk River delayed their arrival until late August when rain raised the river enough for the waiting tug and barge to go upstream.

Because of the delay, the crews worked later than usual to complete the scheduled program. Daily freighting trips have been made by a Nodwell tracked truck of Canadian manufacture between the village of Kobuk on the river and the camp 14 miles distant.

Devonian reef-breccia is the host rock for the mineralization at Ruby Creek, occurring as low-temperature chalcopyrite-bornite-marcasite. Copper showings were discovered by gold prospectors many years ago and abandoned. Bear Creek, exploration subsidiary of Kennecott Copper Corporation, has been conducting surveys and diamond drilling in the area since 1957. Copper grade is reported high in comparison to that of many United States mines, but transportation problems must be solved before any large scale operation can be considered economic.



## Diesel Locomotive Given to Colorado School of Mines

How industry participates in and encourages mining education was demonstrated at the Colorado School of Mines recently with presentation of this 5-ton mine locomotive for use in the school's experimental mine at Idaho Springs, Colorado. The mine gives senior engineering students such as those pictured here a chance to put training to the test under actual field conditions with typical mining equipment. The Diesel-powered locomotive, donated by The Plymouth Locomotive Works of Plymouth, Ohio, and Hercules Motor Corporation of Canton, Ohio, is equipped with a Plymouth exhaust conditioner for underground operation. The students in the group are from the United States, Canada, Brazil, Venezuela, Cuba, Chile, and Burma.

## Cerro de Pasco to Spend $6,825,000 on Peru Projects

Directors of the Cerro de Pasco Corporation have approved an expenditure of $6,825,000 for modification of two production facilities in Peru. The electrolytic zinc plant at La Oroya is to be increased in capacity from approximately 32,000 to 52,000 short tons of special high grade zinc a year. The estimated completion date of this project is June 30, 1962. In addition, the concentrator at the Cerro de Pasco mine in Central Peru, is to be expanded to accommodate increased volume of copper ore and lead-zinc ore to be mined by open-pit methods at that property. This project is expected to be completed by the end of 1961.

The objective of the zinc refinery addition is to reduce to elemental metal in Peru a larger proportion of the total of the zinc concentrates produced. This will reduce transportation costs, and increase Cerro's net realization from sales by reducing the zinc concentrates to metal in its own plant as against exporting them from Peru for refining by others in other countries.

The lead-zinc ore milling section of the Cerro de Pasco concentrator will be increased from 42,000 to 65,000 dry short tons per month, and the copper milling section increased from 35,000 to 50,000 dry short tons a month. This increase in milling facilities, however, will not add significantly to Cerro's annual output. This is because the open-pit ores which they expect to mine in the future are of somewhat lower grade.

## Agglomeration Symposium In Philadelphia Next April

Fundamental aspects of agglomeration will be emphasized at an international symposium to be held April 12, 13, and 14, 1961, in Philadelphia, Pennsylvania, United States. The conference is under sponsorship of the American Institute of Mining, Metallurgical, and Petroleum Engineers.

Those who hope to attend and want further information are asked to write to W. B. Stephenson, general chairman, International Symposium on Agglomeration, P. O. Box 635, Paoli, Pennsylvania. The American Express Company is official agent for travel and accommodations for foreign visitors. The registration fee of $25.00 for AIME members and $27.50 for non-members includes one set of preprints of technical papers at the session, and a volume of proceedings.

Technical papers being written by specialists all over the world will cover all phases of the subject. In order that appropriate discussions can be prepared all papers accepted for the symposium will be preprinted and sent to preregistrants. Abstracts in English, French, and German will be included. English will be the official symposium language.

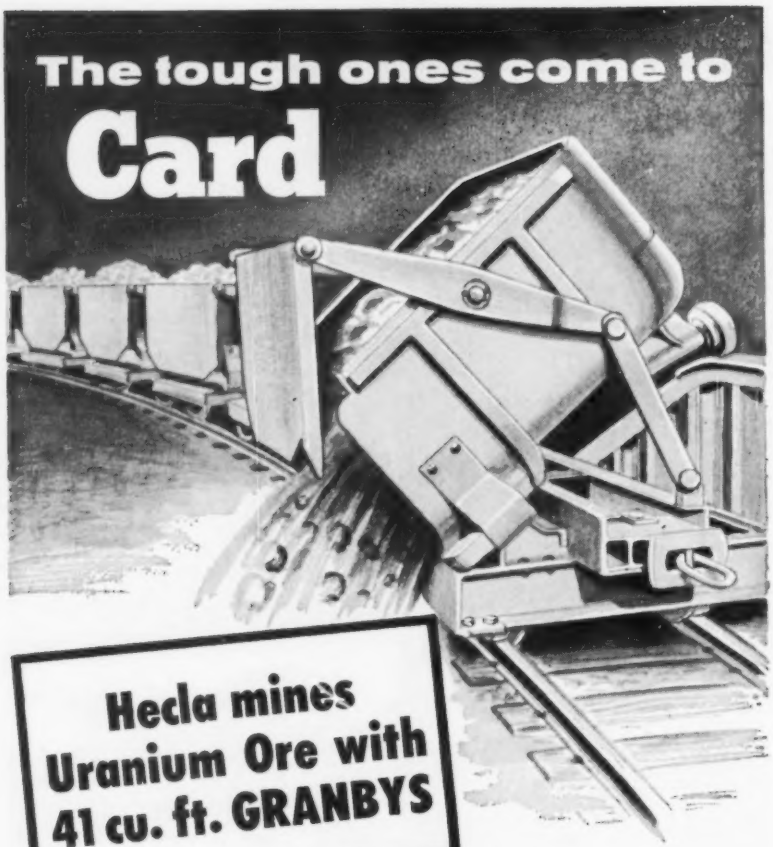
## Alcoa Continues Development Plans for Jamaican Bauxite

Alcoa Minerals of Jamaica, subsidiary of the Aluminum Company of America, has completed prospecting and evaluation of its 30,000-acre bauxite property in the Mocho area of Clarendon Parish. The company's investigations so far indicate that these lands, acquired recently by option, do not have as extensive bauxite deposits as those held by other bauxite companies on the island. However, there is sufficient tonnage indicated to project a sizable mining venture.

Preliminary study of construction plans is being made, according to Maurice Bennett, general manager in Jamaica. The company hopes to start shipping bauxite to Alcoa's refining plant at Point Comfort, Texas, by the end of May, 1963.

Soil tests are being undertaken at Salt River, which is under consideration as a site for building a dock and processing plant. When operations commence, a substantial tonnage of bauxite, in excess of 500,000 tons per year, will be mined. The company's proposed expenditure is approximately $15,000,000 for the project.

Aluminum Company of America will operate four alumina units at Point Comfort, each with a capacity of 187,500 short tons yearly. The first of these was completed last year to treat ore from the Dominican Republic. Jamaican ore is similar to Dominican bauxite and will be processed by the same method.




Hecla Mining Company opened their Radon property with 20 small Granby-type Card cars designed specifically for this underground service. Hecla is operating one of the deepest uranium mines in the U.S.A. with a well planned mine plant.

The underground haulage involves up to 300 tons per day of 0.7 percent $U_3O_8$ ore. Each Card Granby car has a capacity of 41 cu. ft. and is built on 24" gauge. When the Radon orebody is exhausted, the cars will still be able to "outlive" another Hecla mine of comparable size without major repair or replacement.

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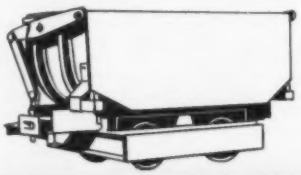

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# Africa

NIGERIA—With Nigeria's attainment of independence October 1, **Consolidated Tin Smelters Ltd.** has announced a decision to build a tin smelter on the Jos Plateau in northern Nigeria. The establishment of a domestic smelter to treat locally produced tin concentrate has been sought by the Nigerian government. Nigeria's production of tin concentrate has hitherto been sold under contract to **Williams Harvey and Company,** a Consolidated Tin subsidiary which has a smelter near Liverpool, England. Negotiations have been under way to renew these contracts, but the constitutional change will fundamentally change the pattern of trade. Nigeria's tin metal output normally runs between 7,000 and 9,000 tons a year.

SENEGAL—First shipment of phosphate from the Taiba deposit was sent to Europe recently by the **Compagnie Sénégalaise des Phosphates de Taiba.** Production is expected to total 2,000 tons a day. Construction has been completed at the port, which has a stockpile capacity of 70,000 tons. The automatic loading system includes conveyor systems for transporting phosphate from railroad cars to the warehouse and from the stockpile to ships. The phosphate after enrichment contains 82 percent tricalcium phosphate.

FEDERATION OF RHODESIA & NYASALAND—**Nchanga Consolidated Copper Mines Ltd.** has formed a new department to be known as the Special Maintenance Planning Department. The new unit, headed by R. D. Wilson, senior planning officer, was created because of the success in construction planning of the large scale plant modifications to conveyors in the concentrator. Functions of the new department will include forecasting future labor strength, scheduling work coming into the Special Maintenance Section, and administration of the bonus scheme in the Section.

GABON—Construction work on the railroad being built for the Mouanda manganese mining operation is progressing rapidly with the two principal projects close to completion by the end of summer. The 200-mile-long railroad is being built for the **Compagnie Miniere de l'Ogooue (COMILOG)** by a group including the **Compagnie Industrielle de Travaux** (France), **Utah Construction Company** (United States), and **Taylor Woodrow Construction, Ltd.** (England). Reserves of the Mouanda deposit are estimated at 100,000,000 tons containing about 50 percent manganese. **United States Steel Corporation** owns the controlling interest in COMILOG, and will be the largest user of the ore. Mining is expected to start this year.

ANGOLA—**Aluminio Portugues** is developing bauxite deposits in the Dondo district in connection with plans to build an aluminum plant. The Dondo plant is expected to start operations late in 1962 with an initial capacity of 25,000 tons of aluminum per year. This will be increased in the second phase to 50,000 tons annually. Power for the plant will come from the Cambambe hydro-electric project on the Middle Guanza River. **Pechiney,** the French aluminum producer active in the project, now has acquired a 10 percent interest in Aluminio Portugues.

TANGANYIKA—Value of mineral exports from the territory increased sharply in the first half of this year over the same period last year. Diamonds, lead concentrate, and gold showed the greatest improvement. Export of copper ore, which began the last half of 1959, continued on a small scale during the first six months of 1960.

NIGERIA—Tin producing targets for **Gold and Base Metals Mines of Nigeria Ltd.** have been raised to match the increased exports permitted under the International Tin Agreement. For the current year, ending in December, the production goal is 780 tons of tin and 75 tons of columbite, with 4 tons of tantalite as a byproduct. Production for the first five months of this year totalled 319 tons of tin and 37 tons of columbite.

SWAZILAND—Negotiations going on at a high level in London concern the development of iron ore deposits in this British Commission territory in South Africa, and construction of a railroad to link the mining area with Portuguese East Africa. The two-part project, involving a probable investment of over $33,000,000, has been under review for some time. **Anglo-American Corporation of South Africa,** which originally surveyed the iron deposits, is reportedly giving favorable consideration to a tentative Japanese offer to purchase the iron for 10 years. Originally Anglo American, only private interest involved in the project, was determined to secure a longer-term purchasing contract from the Japanese. Current London negotiations are concerned with financing the project. The **Colonial Development Corporation** is involved in the discussion and the British government is showing interest to the extent that it may assist that group's participation in the project. Besides the financial problem, which seems to be one of bridging a gap between total outlay and what the two corporations together propose to invest, the future of the program depends on negotiations about the selling price of the ore. A group of Japanese businessmen will discuss this matter on a visit to England this fall.

TOGOLAND—Development of the **Akoumape** phosphate deposit by the **Compagnie Togolaise des Mines du Benin** is scheduled to start soon. Construction of the railway for the project has been completed, a wharf is being built, and equipment for the mine and the concentrating plant is being purchased. Reserves in the deposit are estimated at some 50,000,000 tons containing 65 percent phosphate, which the concentrator will upgrade to 80 percent. Estimated production is 750,000 tons a year of 80 percent phosphate.

MOROCCO—Production of minerals in this country for the first half of 1960 was as follows: Calcium phosphate, 3,579,622 tons; iron, 737,685 tons; metallurgical manganese, 176,547; lead, 65,185; zinc, 45,588; chemical manganese, 41,791; cobalt, 6,013; iron pyrite, 5,368, and copper, 2,366 tons. Compared with the same period in 1969, production increased 16 percent for iron; 9 percent for chemical manganese; 7 percent for copper; 5 percent for cobalt, and 1 percent for calcium phosphate. Production of lead, zinc, and metallurgical manganese was slightly lower than 1959.

UNION OF SOUTH AFRICA—Conversion of its single northern No. 1 shaft to a twin-shaft system is planned by **Western Holdings Ltd.** The conversion will be accomplished by sinking a circular 20-foot-lined-diameter shaft to a depth of 4,500 feet nearby for upcast ventilation, and by changing the existing rectangular shaft, which is bratticed for downcast and upcast ventilation, into a fully downcast unit. The high ground temperature of the goldfield, particularly below the lava, and the need for better ventilation because of extended operations in the northern section make the conversion necessary. The new shaft, which will double the present ventilation rate, will be completed in 1962 at a cost of about $2,240,000. The increased ventilation will also aid in extending development east from the No. 1 shaft up to the Dagbreek fault and the area beyond. It will also permit development in the shallow sub-outcrop zone of the northwestern section. Development and stoping in the high-grade northern zone between the No. 1 shaft and two holes drilled by **Free State Geduld Mines** on the two firms' common boundary will be easier by the shaft conversion.

SIERRA LEONE—The marked success of the Sierra Leone government's measures against illicit mining and dealings in diamonds is apparent from figures for diamond production for the first eight months of the current year. Official purchases by the government diamond office were £7,320,000 compared with last year's record total of £5,750,000. Purchases in August totalled £839,000, an improvement over the two previous months.

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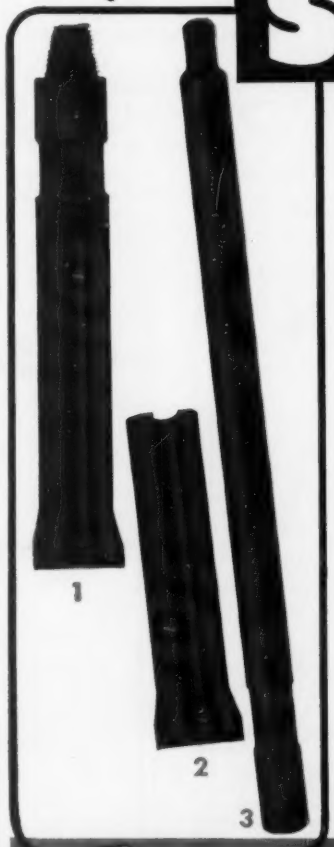


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# Oceania

QUEENSLAND—**British Aluminium Company** will relinquish to **Consolidated Zinc Corporation** its interest in the proposed scheme for development of bauxite deposits at Weipa in northern Queensland. Each company has held a half-interest in **Commonwealth Aluminium Corporation (COMALCO)** formed in 1956 for the Weipa project and also to examine the much smaller bauxite resources at Gove in the Northern Territory. The Gove lease is now being transferred to British Aluminium, which will also acquire rights to hydroelectric developments in Papua by obtaining the entire share capital of the **New Guinea Resources Prospecting Company.** The Australian government now owns 51 percent of this firm. British Aluminium, controlled by **Tube Investments** and **Reynolds Metals Company,** is believed to be more interested in projects that will become operational in the immediate future. The Queensland development is not expected to be in full operation for 15 to 20 years.

WESTERN AUSTRALIA—**Laporte Titanium Ltd.,** British chemicals firm, is showing renewed interest in titanium oxide production based on an estimated 15,000,000 tons of ilmenite in the Bunbury Busselton area. Laporte first studied the situation in 1956-1957, but decided production would not prove profitable. An important aspect of the project would mean processing a raw material now being exported from Bunbury. Recently a 1,300-ton shipment of ilmenite went from Bunbury to the Laporte works at Grunsley in England.

QUEENSLAND—There are growing indications that the Constance Range iron ore deposit 170 miles from Mt. Isa will assume greater importance. Survey work has been undergoing for several years by **Broken Hill Pty. Ltd.** geologists. The field is low grade, but of considerable size, extending over 1,000 square miles. Despite difficulties of access, the deposit may well be a major addition to Australia's iron ore reserves. (See MINING WORLD, March 1960, page 77)

TASMANIA—An increase of some 3,000 tons of zinc metal produced was achieved by **Electrolytic Zinc Company of Australasia Ltd.** at Risdon for the year ended June 30. The company's West Coast mines also showed a production rise for the year. Comparative figures, in long tons, are; ore treated, 205,341 tons in 1960 and 197,936 in 1959; lead concentrate produced, 10,733 and 9,885; zinc concentrate produced, 59,083 and 58,930 and copper concentrates produced, 6,640 and 6,549 tons.

WESTERN AUSTRALIA—A mineral production record for Western Australia was set in the calendar year 1959 according to the annual report of the Western Australian Mining Industry by A. H. Telfer, Undersecretary for Mines. Gross value of mineral production was £21,796,605.

NEW SOUTH WALES—Production of **National Mineral Holdings Ltd.** for the 52 weeks ended June 26 was 7,658 tons of rutile and 5,913 tons of zircon. All of the output was from the company's leases at Redhead near Newcastle. Total for the previous fiscal year was 5,724 tons of rutile and 4,976 of zircon.

REPUBLIC OF THE PHILIPPINES—During the 29 operating days of July **Lepanto Consolidated Mining Company** treated 37,020 tons of ore producing 4,447 tons of concentrates containing an estimated 2,278,060 pounds of copper and 4,278 ounces of gold (returnable gold at 4,192 ounces). Average copper content of ore treated was 3.24 percent; average gold content, 0.150 ounce per ton. Concentrates produced contained 25.61 percent copper and 0.1962 ounce of gold per dry short ton. Copper recovery during the month was 94.9 percent; gold recovery, 76.8 percent.

WESTERN AUSTRALIA—Drilling by **Western Mining Corporation** on its bauxite leases in the Darling Ranges indicates reserves of 37,000,000 tons of bauxite with very satisfactory chemical and physical characteristics. Of this amount, 13,000,000 tons can be mined at 47 percent aluminum oxide. The company reports that the area drilled so far is only a minor part of that known to contain bauxite. Western Mining is continuing arrangements to supply trial shipments of bauxite to Japan, with three 10,000-ton shipments to three Japanese producers sent during July and August. If test results are satisfactory, the Japanese firms have indicated they could take up to 300,000 tons a year. These exports would be approved by the Western Australian government, which has given a blanket authorization of up to 1,250,000 of bauxite during the next five years.


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9—Model 12 Caterpillar Motor Patrols, 8T, 80D, 70, and 71D Series.

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8—Model LRVX Mack Tractors w/Model 137W Euclid 30 cu. yd. Bottom Dump Trailers powered by NVH-12-B1 Cummins Engines; 10—Model PH95AC International Payhauler Tractors w/Model PW20 30 cu. yd. Athey Bottom Dump Trailers.

**END DUMP EUCLIDS**

5—Model 46TD Euclid End Dump Units, 15 cu. yd., powered by Model NHRBIS Cummins Engines; 10—Model 63TD Euclid End Dump Units, 15 cu. yd., powered by Model 6-110 GMC Engines.

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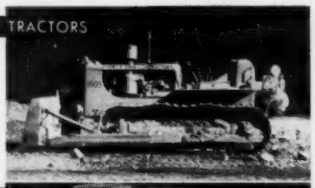
1—Model 175ADS Michigan 3 cu. yd. loader powered by Model 135DKBS Waukesha Engine; 1—Model D4 Caterpillar Loader w/Model EA4 Trackson Loader.

**CRAWLER TRACTORS**

15—Model D9 Caterpillar Tractors w/P.C.U.'s and Dozers, 18A Series (Note: 4—Ateco Hydraulic Rippers available for above); 21—Model D8 Caterpillar Tractors w/P.C.U.'s and Dozers, 14A Series (Note: 6—Caterpillar #8 Hydraulic Rippers available for above).



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30—Model DW20 Caterpillar Tractors w/Model 456P Modified Scrapers, 67C and 88E Series; 10—Model DW20 Caterpillar Tractors w/Model PW20 Athey Wagons, 88E Series; 2—Model 33LDT Euclid Tractors w/Model 32SH Scrapers.

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1—Model TWM2A Joy Quarry Drill w/T500 Drills, pneu. tires; 3—Model TWM-5 Joy Quarry Drills w/T500 Drills, pneu. tires.

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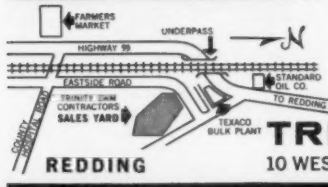


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## WHAT'S GOING ON. . .

### INTERNATIONAL

PAPUA—Operations of **Pacific Island Mines Ltd.** on Misima Island during the last few months have been concentrated in the East Imgubinaina area where further extensions to three lode structures have been located. Since last December some 15,500 feet of trenching have been completed. Continued testing shows that the combined surface length of the three lodes is at least 2,700 feet, with exposed widths from 5 to 45 feet. No. 1 lode has been traced over a horizontal distance of some 2,200 feet and vertical range of 300 feet. Indications from the operations are that the three lodes together contain prospective reserves of 20,000 to 300,000 tons above creek level, all of which could be cheaply developed by adits. Most of the gold content occurs free as fine gold. To determine grade of reserves the company will set up a pilot plant with some sections in operations by the end of the year. Bodies of manganese dioxide which occur as an oxidation product will be studied later. The company has begun underground exploration with the first adit being driven along No. 1 lode from the eastern side of Imgubinaina Creek, but most of the work force has been used for construction work and plant site preparation.

WESTERN AUSTRALIA—Japanese interests may bring about renewed activity in one of Western Australia's major copper areas at Whim Creek. A test shipment of 4,000 tons of 10 percent ore is being sent to Japan for determination of the most efficient type of treatment plant for the ore. **Rosa Trading Company** of Japan has purchased 55 percent of the options held by the **Depuch Shipping and Mining Company Pty. Ltd.** Two Japanese technicians, who have been at the mine for a month, estimated that 350,000 tons of ore were visible, and it is believed that over 1,000,000 tons of ore exist in the area. Plans have been made for sinking a shaft in the near future.

QUEENSLAND—Copper production by **Mt. Morgan Ltd.**, copper and gold producer, during the fiscal year just concluded increased 449 tons for a total of 8,292 tons.

REPUBLIC OF THE PHILIPPINES—**Palawan Quicksilver Mines Inc.** is conducting experiments to treat low grade ore and if these are successful necessary equipment will be purchased. According to Mary A. Marsman, company president, it is only through utilization of the low grade ores or fines that the life of the mine can be extended and remain able to compete with foreign producers. The mercury mine is located near Tagburos on Palawan Island.

QUEENSLAND — Establishment of treatment plants in the Cloncurry-Mt. Isa-Bourketown mineral fields has been under discussion by **Nippon Mining Company** of Japan, government officials and small miners in the area. The Japanese firm is considering investment of over $2,800,000 on the project along with purchase of at least $1,400,000 worth of copper a year. Earlier this year Nippon representatives carried out exhaustive studies in the region, investigating potential fields in a 30,000-square mile area.

NORTHERN TERRITORY—New disclosures of good grade pitchblende ore east of the **Rockhole** workings of **South Alligator Uranium N. L.** indicate that the mine ore zone extends eastward for another 1,000 feet. The extension of the ore zone is being explored with two new levels.

## Australian Dredge Recovers Heavy Minerals

This floating rutile separation plant launched recently at Redhead near Newcastle, Australia, is designed to produce a plus-80-percent heavy mineral concentrate from a head feed as low as 0.5 percent. Through-put capacity is 300 tons per hour. The dredge, Titian, was designed and built by the staff of the owners. National Minerals Pty. Ltd. Total displacement is 390 tons with flotability by a series of cylindrical tanks 40 feet long and 4.5 feet in diameter. Concentrate recovered by 240 rubber rougher spirals is retreated by 45 secondaries and then pumped to 27 tertiaries. Final concentrate is pumped to the mineral dump on shore for transportation to the company's dry separation plant at Wickham. The dredge is 115 feet long and 42 feet wide, with 10 feet between decks. Only three operators, one each on the dredge, dragline, and spirals, are necessary. Total value of the unit, including a complete workshop and electrical shop, is £150,000. Picture provided by J. E. Fawdry, Manufacturers' Mutual Insurance, Ltd., Sydney.

**THE JOB:** Removing an average of 55 feet of overburden at bauxite mine site, a total of 1,200,000 yards to be moved in six months.

**Contractor:** Dulin Co., Inc., Sweet Home, Ark. Location: 12 miles southwest of Little Rock.

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# Europe

SWEDEN—**Tuolluvaara Mining Company** has completed sinking a shaft at its mine about four kilometers from Kiruna in northern Sweden. Sinking started at the 320-meter level and was completed at the 500-meter level, just below the surface of the sea. Sub-drifts have been driven about every 50 meters, and ore pockets installed at some levels. The new shaft will permit an increase in production from the present 450,000 tons to 600,000 tons of iron ore per year. A new concentration plant has been built to handle the increased output.

ITALY—Italian exports of mercury metal during the first half of this year amounted to nearly 818 tons valued at 2,800,000,000 lire. Last year's comparable figures are 412 tons for a value of 1,500,000,000 lire.

SPAIN—During the last nine months production and export of iron ore have staged a considerable comeback, with both Germany and England making heavy purchases. Average monthly export to England has been 77,500 tons, compared with 44,600 tons in the same period of 1959. However, although this year may bring a record in iron ore exports, more export difficulties are foreseen in the future because of the development of large deposits elsewhere, and the increasing number of large ore carriers for which Spain has no loading facilities. Competition will also be offered with the expected output of the Mauritania mines in the western Sahara, with practically the same freight costs as Spanish ore, but with a 62 percent Fe content against the 45 to 50 percent Fe of average Spanish ore. On the other hand, the rapidly expanding Spanish steel industry will require a higher portion of the national ore output in future years.

NORWAY—Excavation and sinking of the shaft have been started by **Folldal Verk A/S** at the new pyrite mine at Tverrfjeld, near Hjerkinn railway station. The company plans to get the headframe and barracks completed before winter. A power line from the **Folldal** mines to Tverrfjeld was completed this summer.

YUGOSLAVIA—Although exact data is unavailable, production of gold in Yugoslavia is presently between two and three tons per year. Biggest amount comes from the **Bor** copper mines, where gold is a byproduct of copper electrolysis, and the **Trepca** lead-zinc mines, which produce about 300 kilograms a year through flotation. Some gold comes from the **Lece** gold-lead-zinc mine which has a cyanidation plant, and a fraction of the yearly output is obtained from the **Blagojev Kamen** gold-tungsten mine. An increase in output is expected with start of operations at the Majdanpek copper mines, which will increase total copper production in the country to 66,000 annual metric tons. Studies are being made in regard to possible development of placer mining in alluvial river sand. The Trgovishki Timok river has 0.2 to 0.4 gram of gold per cubic meter of sand, while the Pek river in eastern Serbia contains 0.119 to 0.348 gram per cubic meter. Sand in the Macedonia Konjska and Anska Reka rivers contains 0.086 to 0.320 gram per meter. The Bosnian river, Lasva, is also the subject of investigation. The Mura and Drava rivers have been sources of gold for several hundred years and mining there continues with primitive methods.

SPAIN—An 18-hectare claim, which reportedly contains silver, has been taken out in Guadalajara. Ore was extracted from this deposit some 130 years ago, but the operation was abandoned as in the better-known **Hiaendalaencina** mines, where depth of the ore makes development difficult.

UNITED KINDOM—The Imperial Smelting Process (lead-zinc blast furnace) of **Consolidated Zinc Corporation Ltd.** continues to provoke world-wide interest and the corporation looks forward to further royalty benefits from the process. At least two more licenses for its use are now under discussion. Actual benefits from the new process during 1959 have been relatively small, with only one furnace at Avonmouth using it. In the second quarter of this year, however, a larger furnace at Swansea started operation with the method and this is expected to bring considerably greater benefits. Revenue from licensing mounted to about $1,200,000 in 1959.

SWEDEN—Construction of new port facilities at Lula in northern Sweden will be started this fall by **Luossavaara-Kiirunavaara AB.** The port will be able to handle vessels of 35,000-ton-capacity; loading capacity will be at a rate of 6,000 tons per hour. Automatic storage facilities for 4,000,000 tons of ore, with addi-


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tional space for another 1,000,000 tons, will be included. According to LKAB's managing director, Arne S. Lundberg, the port, scheduled to be completed by 1964, will receive ore from Malmberget and other mining areas. Capacity of the railway serving the port will be increased initially to about 8,000,000 tons yearly.

YUGOSLAVIA—A considerable increase in mining and metallurgy is planned during this year on the basis of the Federal Social Plan for 1960. Expected increase in the steel industry is 11 percent, with a goal of 1,390,000 tons, about six times the pre-world War II output. Production of aluminum will be increased by 5,000 tons to 24,000 tons this year. A four percent increase is planned for non-ferrous metallurgy, and a 10 percent expansion in production of non-metals. Blister copper produced in 1959 increased to 32,251 tons; electrolytic copper to 31,567 tons; refined lead to 85,395; zinc to 31,951; antimony regulus to 2,281; quicksilver to 460 tons, and iron alloys to 40,079 tons. Production of aluminum ingots decreased slightly to 19,245 tons during last year.

NORWAY — **Christiana Spigerverk, Oslo,** will soon start mining nepheline syenite on the island of Stjerno near Hammerfest in north Norway. Initial production will be about 45,000 tons per year. Employment is about 20 men.

UNITED KINGDOM—Although the chief producers of strontium are the United Kingdom, Mexico, and Germany, the United Kingdom leads as the main supplier of strontium, sulphate, or cecestershire and Somerset, where the ore occurs in irregular masses, principally near Yate. Although over 500,000 tons have been mined in the last 80 years, reserves still appear to be substantial. The celestite occurs as nodules. After it is crushed to about 2½-inch size, it is dried, and adhering clay and dirt removed by air separation. The final product is then ground for shipment.

YUGOSLAVIA—Production of refined lead from the **Trepca** mines, Europe's biggest lead-zinc project, will be increased gradually from the 1959 output of 71,000 tons to 100,000 tons. Total production is presently over 600,000 tons of ore per year, although grade is decreasing as lower horizons are reached. Average grade now is still over 7 percent lead and over 4 percent zinc. The Trepca smelter also treats ore and concentrate from several other lead and zinc mines—**Rudnik, Lece, Suplja Stena, Veliki Majden, Novo Brdo, Zletovo** and others. Capacity of the lead furnaces is now twice what it was before World War II. The smelter includes a furnace for lead alloys and a modern plant for roasting concentrates. The lead refinery has been enlarged to 12 refining kettles of 300 tons each. Some zinc concentrates are smelted in Celje, in the western part of the country, while others are refined in the new electrolytic plant in Sabac. Yearly output of by-products includes 90 metric tons of bismuth, 90 tons of silver, 100 tons of zinc chloride, and 300 kilograms of gold. Scheduled to start soon is delivery of pyrite concentrate from the mine to the sulphuric acid and fertilizer plant being built nearby. A study of possibilities for production of iron, manganese, and other products from Trepca and the surrounding vicinity is under way.

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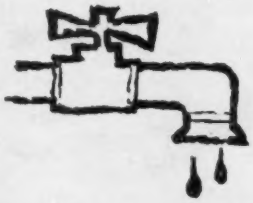

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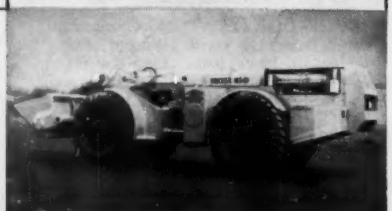
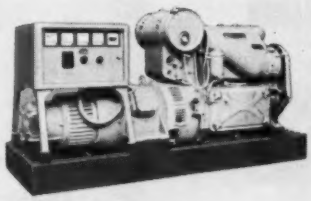
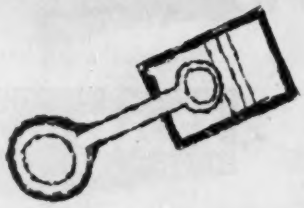


Good reasons why Wagner ore carriers, Wagner scoopmobiles, the Jones Jackass and the Young Shuttle Buggy run on Deutz Diesels, too.



Deutz air-cooled Diesels are also used on generators, compressors, stand-by power equipment.



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# Canada

BRITISH COLUMBIA—A 2600-foot tunneling job is planned by **Cariboo Gold Quartz Mining Company** from the 2850-foot level of the Aurm shaft at Wells, to reach the Burnett ore zone, where mantas type ore bodies have been indicated by diamond drilling. The 3125-foot level also will be extended to the ore zone.

LABRADOR—**British Newfoundland Corporation** has been engaged in 13 exploration projects during the last year, most of them as joint ventures. One of these, on which work continues, is a joint undertaking with **Southwest Potash Corporation,** subsidiary of **American Metal Climax Company,** involving a molybdenite occurrence in Aillik Bay. In another joint venture adjoining this area, molybdenite is also indicated. A subsidiary, **British Newfoundland Exploration Ltd., (Brinex),** and its partners are investigating two base metal prospects in the Halls Bay area where a two-year extension of exploration rights has been given by the Newfoundland government.

LABRADOR—**Iron Ore Company of Canada** recently started operations at a new Knob Lake area mine which has reserves estimated at 14,000,000 tons of direct shipping ore, plus a few million tons of ore suitable for upgrading by simple washing methods. Located three miles southwest of Schefferville, it is the **Wishart** mine, named after Dr. J. S. Wishart of the famous James and Gill expedition that explored the Labrador wilderness in 1929. The Wishart No. 1 orebody was located in 1943 when high grade blue ore was found in a shallow ravine crossing the ore body. A 3,800-foot drilling program in 1948 indicated an original reserve estimate of 12,800,000 tons. Trenching was undertaken in 1957-1958, followed by detailed drilling. Stripping of the shallow overburden was done this June. The mine is a direct loading operation connected by a 4.8-mile-long railroad spur to other mines in the area.

NORTHWEST TERRITORIES—The **Giant** mine of **Giant Yellowknife Mines Ltd.** set a new record production figure during the last year, treating an average of 997 tons of ore per day with an average overall recovery of 80.86 percent of the contained gold, producing bullion to the value of $7,694,490. In the past year the mine was operated by the former **Giant Company** from July 1, 1959, to June 27, 1960 and thereafter for the account of **Consolidated Sudbury Basin Mines Ltd.,** which was amalgamated June 30 with **Giant Yellowknife Gold Mines Ltd.** to form the present company. Total production of gold during the year was 230,387 ounces, and of silver, 25,795 ounces. Amount of ore milled was 363,496 tons. During the current year station-cutting was completed on the mines C-shaft; loading pockets were installed; ore and waste passes driven as required, and the pumping plant revised to handle the water flow from new levels. The lateral development rate has been gradually increased so that an average of 1,460 feet per month was reached, compared with an average rate of 361 feet the previous year. A rate of about 1,500 feet per month will be maintained in the coming months. When the zone on the 2,000-foot level was intersected by the crosscut from the C-shaft, diamond drilling from the crosscut indicated that the zone flattened slightly below that level and rose again to the east. To determine structural conditions existing on this section, the crosscut was extended for several hundred feet and drilling to date indicates the zone continues to the east in a series of anticlines and synclines. No ore had been encountered in the crosscut at last report, but one mineralized zone has been found.

BRITISH COLUMBIA—**Silver Standard Mines Ltd.** is completing production plans for its **Harriet Harbor** mine after concluding negotiations with **Sumitomo Shoji Kaisha Ltd.** of Japan for purchase of 1,000,000 long tons of 62 percent iron concentrate over a four-year period starting in 1962. Sumitomo will aid in equipping Silver Standard's property for production by advancing $1,000,000. Canadian interests are expected to furnish the balance of the $2,500,000 preproduction costs. Ore reserves on the Queen Charlotte Island property are estimated at 2,626,000 tons of ore, averaging 51.9 percent iron.

NORTHWEST TERRITORIES—Prospectors employed by the **Nahanni Sixty Syndicate** have recently found interesting mineralization in the South Nahanni area of this province. Staking of claims and preliminary sampling are being completed. Several New York and Toronto mining men and companies are members of the syndicate, including **Northfield Mines, Inc., Strathdon Corporation Ltd., National Explorations Ltd., Nordain Explorations Ltd., Rayrock Mines Ltd., Rio Tinto Canadian Explorations Ltd.,** and **Guggenheim Brothers.**


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CANADA—Sales of aluminum from Canada to Red China are playing an important part in trade between the two countries. The Chinese import aluminum ingots to process into sheets, foil, and other products for domestic consumption and export. It has been reported that practically all aluminum products are being fabricated in China. In the first five months of this year Canada exported to Hong Kong 18,250,400 pounds of ingots valued at £1,680,000, and in the same period Hong Kong re-exported to China 9,173,100 pounds of ingots. Last year Canada exported to Hong Kong 19,774,600 pounds valued at £1,300,000, and Hong Kong re-exported to China 7,570,200 pounds.

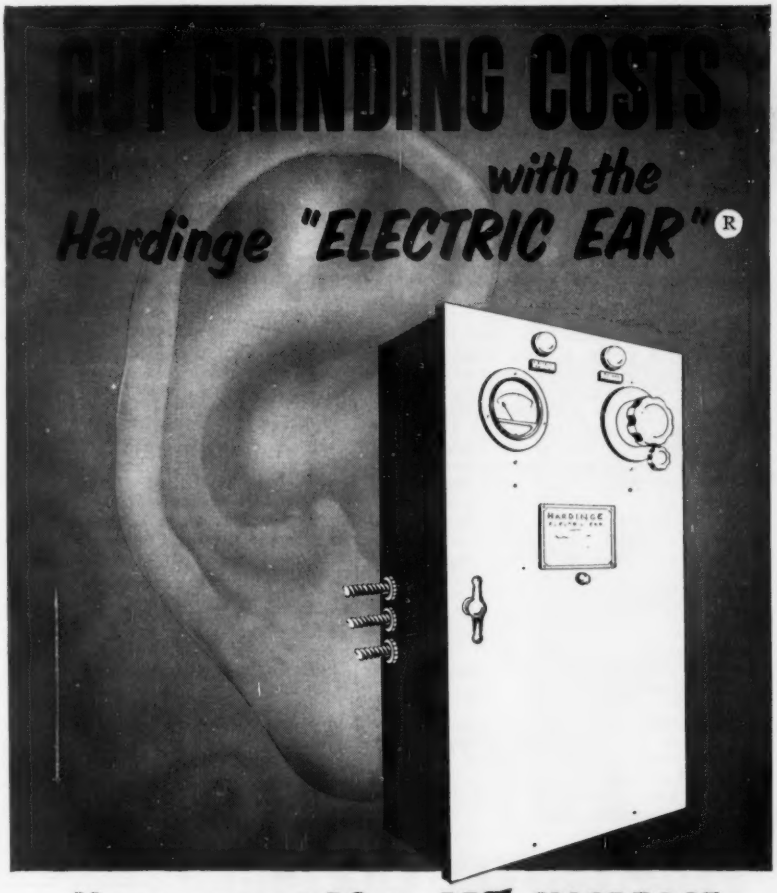
QUEBEC—**Quebec Smelting & Refining Ltd.** is establishing a pilot plant in Ottawa to carry out tests on taconites, uranium ores, and other special applications of the Jones wet magnetic separator, for which it has taken over United States and Canadian rights. Director of the project is W. J. Dennis Stone, who is carrying out further research in connection with commercial applications, with particular emphasis on upgrading of iron, tungsten, and phosphate ores. Mr. Stone was previously associated with Prof. G. H. Jones in development of the separator.

MANITOBA—A new mine, the **Chisel Lake**, owned by **Hudson Bay Mining & Smelting Company**, came into production in September at the rate of 1,000 tons per calendar day. The ore assays 11 percent zinc and lead content is about 1 percent. Lead concentrate will also contain less than 1 percent copper, and good gold and silver values. At Hudson Bay's other Snow Lake area mine, **Stall Lake**, drilling continues but the development stage is about two or three years ahead.

BRITISH COLUMBIA—**Continental Consolidated Mines** is carrying on drilling exploration at the **Stemwinder** mine near Phoenix to determine the feasibility of an open-pit mining operation. Stockpiled ore on the dump at the Stemwinder mine shaft is being milled by **Phoenix Copper Company** in its new mill.

ONTARIO—Unwatering of the King Edward shaft on the **Silver Cliff** property of **United Cobalt Company** is well under way. **Rio Tinto Canadian Exploration** is carrying out the work on behalf of **Rix-Athabaska Company** which has an option on the property. Riocanex intends to explore the lower contact of the Keewatin rocks where, on the King Edward property, considerable silver has been recovered. On United Cobalt's Genesee claims to the north, a surface diamond drilling program is in progress.

BRITISH COLUMBIA—As its first move abroad, the **Susquehanna Corporation** of Chicago, Illinois, has entered into option agreement with **Raidor Gold Mines Ltd.** of Toronto to conduct explorations of Raindor's mining properties near Revelstoke. The Canadian operations of the United States uranium producer will be conducted through a wholly owned subsidiary, **Susquehanna Metals Ltd.** The Raindor properties consists of deposits of gold, silver, lead, zinc, and minor amounts of copper and cadmium. Susquehanna will exercise its option only if sufficient ore is proven to support an integrated mining and milling operation.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# Asia

MALAYA—Four tin companies near Ipoh have nearly completed a ten-year project to divert 38 miles of the Kinta River to make available tin-bearing sand on the river's bed. Company officials believe the bed holds 20,000 tons of tin metal. The companies involved are **Southern Kinta Consolidated Ltd., Southern Malayan Tin Dredging Ltd., Pengkalen Ltd.,** and **Lower Perak Tin Dredging Ltd.**

TURKEY—Reprints of the widely used "Guide to the Known Minerals of Turkey" by C. W. Ryan are now available by requesting them from the **Mineral Research and Exploration Institute of Turkey,** Ankara, or to the **United States Operations Mission to Turkey** at Ankara. A special map accompanies this volume showing all the major mineral occurrences in Turkey at a scale of 1.0 to 2,500,000. All available details of known mineral deposits are reported in this 196-page book under four chapters: A. Precious, non-ferrous, and minor metals; B. Iron, ferro-alloy metals, and metallurgical and refractory materials; C. Ceramic materials, and industrial and manufacturing materials, and D. Chemical fertilizer, abrasive, and miscellaneous materials.

MALAYA—Production of iron ore, bauxite and ilmenite showed an increase for the first half of 1960 over last year's output. Iron ore production increased from 1,662,613 tons in 1959 to 2,551,140 tons in 1960; bauxite from 171,317 to 227,404 tons, and ilmenite from 26,874 to 64,368 tons. Comparison of iron ore production shows that if the current output rate continues through the year, the production record of 3,700,000 tons set in 1956, will be substantially outstripped.

INDIA—Iron ore found in Salem, Madras State, can be smelted with lignite from Neyveli, also in Madras, in low shaft furnaces to make pig iron, according to an East German team that has studied the situation. In its preliminary report to the government, the survey team said the project could be undertaken in two stages, with six furnaces producing 300,000 tons yearly in the first stage. In the second phase installation of four additional furnaces could increase capacity to 540,000 tons per year.

MALAYA—**Petaling Tin Ltd.** is considering renewal of operations by one of its idle dredges. Areas previously worked by No. 3 and No. 4 dredges still contain some economic values below their digging depth and preparations are being made to work part of the areas by open-pit methods, using a bucket wheel excavator. The company has applied for assessment as a new mine under the tin control regulation.

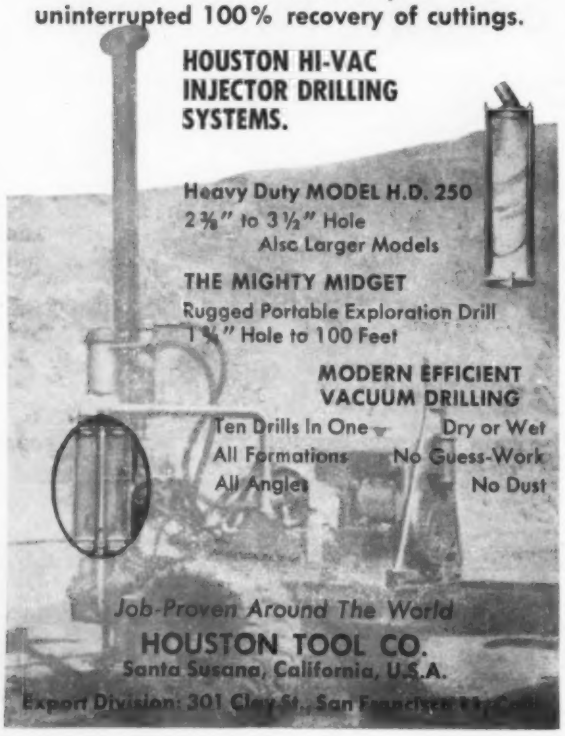
INDIA—Final plans have been made by **Indian Copper Corporation Ltd.** in its project for manufacture of electrolytic copper and wire bars. Target date for completion of the refinery is the end of 1962. The company expects during the current year to make up for last year's low production of fire-refined copper, caused by a smelter breakdown in December.

THAILAND—The government of Thailand, a major shareholder in **Aokam Tin Ltd.,** is studying methods of improving operating results of the company's Pibul dredge, a sea-going ship equipped with two clamshell buckets and an ore-dressing plant.

INDIA—Negotiations are underway for a barter agreement in which West Germany will supply certain machinery and equipment in exchange for Indian manganese and iron ore, provided the prices are competitive. Indian ore prices are said to be 16 to 20 percent higher than other supplying countries, such as the USSR, Brazil, and Africa. Excessively high inland freight costs and expensive loading arrangements at harbors contribute to the high cost of Indian ore.

MALAYA—**Selayang Tin Dredging Ltd.** is now using its dredge on land near its present property. The company hopes to start test boring soon, although some time will elapse before a mining lease can be obtained and suitable arrangements concluded. The company has obtained prospecting licenses over considerable areas, but because of high costs of moving plant and equipment, has arranged to have another company prospect the area. That company has been given an option to acquire selected areas when mining leases are approved.

INDIA—**The National Development Corporation** plans to begin work shortly at the renowned Panna diamond project in Madhya Pradesh. Occurrences of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1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publishers: Wm. B. Freeman, Miller Freeman, Jr., 500 Howard Street, San Francisco 5, California; Editor: George O. Argall, Jr., 500 Howard Street, San Francisco 5, California; Sales Manager: H. G. Grundstedt, 500 Howard Street, San Francisco 5, California; Business Manager, none.

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3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: NONE.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner. 5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 10,461. Miller Freeman, Jr., Publisher. Sworn to and subscribed before me this 1st day of October, 1960. (Seal) Barbara M. Hampson, Notary of the Public, San Francisco, California. (My commission expires February 18, 1962.)

diamonds have also been reported from the bed of conglomerates near Banganapalle in Andhra Pradesh, according to the **Geological Survey of India.** The mining lease in that area was previously held by a private party, but has now expired.

MALAYA—**The Hong Kong Tin Ltd.** expects to renew operations with its dredge in Selangor this fall. The dredge was closed down in 1958 because of output restrictions under the International Tin Agreement. Plans call for working the dredge in low-grade ground the first four months, after which output is expected to improve.

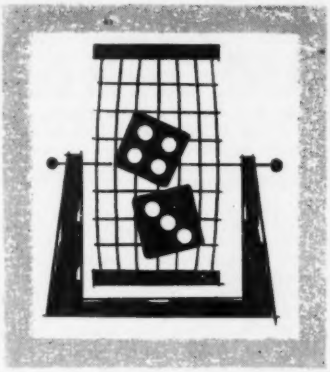
INDIA—A project report by the Department of Mining and Geology calls for establishment of a mining and beneficiation plant that will produce 15,000 tons of metallurgical grade fluorspar yearly. The plant would be built in the Durgarpur district where a geological survey and prospecting during the last three years has indicated existence of an estimated 5,000,000 tons of fluoride ore of about 30 percent purity. Diamond drilling to 200 feet proved that seven hillocks in a 20-square-mile area near Mando-ka-pal contain the fluoride ore. In the third Plan period India would be able to use 10,000 to 15,000 tons of the ore yearly so the development of Durgarpur deposits will mean a considerable foreign exchange saving.

INDIA — The current intensified program to develop the country's mineral resources may increase the number of geologists in the **Geological Survey of India** to 1,400 by the end of the third Five-Year Plan period. In 1939 the survey had a technical staff of only 30. Increased emphasis is being placed on mapping, drilling, base metals, geophysical exploration and geology.

MALAYA—Drilling by **Ayer Hitam Tin Dredging Ltd.** has proved that mining leases in the Ulu Langat district of Selangor State hold some of the richest tin-bearing land in the world. The company's new dredge is believed to have recovered about 300 piculs of tin concentrates per day (1 picul equals 132-140 pounds). The No. 1 dredge will be shut down in October for several months during conversion to electric drive, replating the pontoon, and other improvements aimed at increased recovery. The remaining No. 2 dredge will not be able to make up for the decreased production, but it is estimated that substantial profits can be made if the International Tin Agreement quota remains at the present level.

PAKISTAN—According to Foreign Minister Manzoor Quadir, discussions have been held between Pakistan and the Soviet Union for exploitation of this country's mineral and oil resources.

MALAYA—Mining at two open-pit gold mines in the **Batu Pappan** district of Kelantan state was scheduled to start this fall. The mines, operated by two Chinese, can be reached only after a long train ride, a two-hour boat journey and a three-hour walk through the jungle. The mines are nine miles from Gua Musang, a jungle railhead. The mining lease was issued before the 1939 war but because of subsequent Japanese occupation and then Communist terrorist aggression, operations were never begun. The operators renewed their lease last year.

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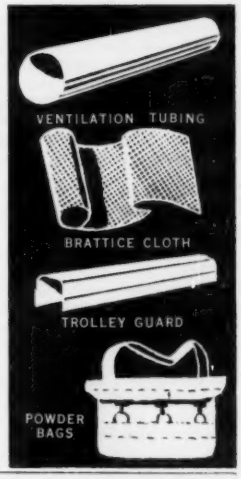


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# Latin America

PERU—**Kennecott Copper Corporation** is conducting intensive geophysical and geological investigations in an area about 15 miles southwest of the **Cerro de Pasco** copper mine in central Peru. Claims covering these lands belong to **Compania Administradora de Minas** and were leased to Kennecott a few months ago.

BOLIVIA—During the first nine months of this year **Patino Mines & Enterprises Consolidated** was paid an estimated $303,700 after expenses by the Bolivian government, slightly less than receipts in the like period of 1959. The payments, termed retentions, are based on a percentage of the price of tin in concentrate shipped from the mines formerly owned by Patino and expropriated by the Bolivian government in 1952. The mines are now operated by **Corporacion Minera de Bolivia**, an agency of the government.

CHILE—According to Roberto Vergara, Minister of the Treasury, the agreement between three United States copper companies and the Chilean government for additional investment in Chile's mining industry is virtually completed. The agreement calls for investment of $400,000,000 to increase copper and molybdenum production by some 200,000 metric tons yearly. **Braden Copper Company, Kennecott** subsidiary, will invest $200,000,000, while the **Anaconda Company** and **Cerro de Pasco Corporation** are planning projects costing each $100,000,000.


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MEXICO—One of this country's major steel producers, **Hojalata y Lamina,** has begun an expansion program that includes building a new steel plant in Mexico City. The company uses the HyL direct reduction process. Iron ore is supplied by **Las Encinas S.A.,** which is engaged in an expansion project to accelerate development of its known reserves and seek additional sources through regional exploration.

PERU—The discovery of a large iron ore deposit in the Province of Castrovirreyna, Department of Huancavelica, has been reported in Lima. Located approximately 200 kilometers from the coast, the prospect is at an elevation of about 4,500 meters and reportedly extends for some 52 kilometers. First samples assayed range from 56 to 72 percent Fe.

BOLIVIA—**Bolivian Mining Corporation (COMIBOL)** has contracted with **Andean Geo Service** for an aerial-photographic, geophysical, and geological survey over an area covering 30,000 square kilometers. Sr. Guillermo Bedregal, general manager of the nationalized tin mining firm, and Sr. Goosen Broersma of the survey company recently signed the contract for the study aimed at developing new ore sources for the Bolivian tin industry.

CHILE—A bill containing plans for reconstruction of the southern zone of Chile, ravaged by earthquakes in May, has been adopted by the Chilean Senate's joint committees of finance, economy, and public works. One clause of the bill provides that United States copper companies subscribe to the Government loans equal to 20 percent of annual profits they take out of the country during the next five years. The loans will be of 10 years' duration and will bear no interest. Any investments undertaken by such companies for modernizing or expanding plants will be deducted from the 20 percent. Another clause calls for United States copper firms to reimburse the government, within 90 days after the bill becomes law, for extra income obtained from the currency exchange rate modification enforced by the government in December 1958. These amounts will be determined by the Copper Department.

MEXICO—A joint venture to reopen the old **La Constancia** mercury mine has been started by **Nomura Mining Ltd., Mitsubishi International,** and **Associated Metals and Minerals Corporation.** The mine is located in the municipality of Guadalcaza, San Luis Potosi.

BOLIVIA—An option on the Chicote Grande wolframite deposit, said to be the largest in this country, has been taken by Messrs. Bartos and Grillo, who plan to start operations in the near future. The deposit contains 83 wolframite veins assaying between 1 and 7 percent $WO_3$. Veins are a foot or more in width.

BRAZIL—**Exploracao de Mineros Brasilia Limitada** is carrying out exploration work, particularly in the State of Minas Gerais and adjacent areas. The firm is a partnership incorporated in Brazil for this purpose by **Pato Consolidated Gold Dredging Ltd.** and **Placer Development Ltd.,** both of Canada. Exploration of a general scouting nature was undertaken in several areas of Central Brazil earlier. Pato has abandoned its venture on the Jequitinhonha River where 114 holes were drilled and two shafts were sunk. Gold and diamonds were indicated by drilling, but the gold concentration was too low to eliminate the risk involved in dredging solely for diamonds whose recovery from alluvial deposits in large volumes of gravel has yet to be determined.

ECUADOR—A study of iron and mercury deposits is being made by a four-man mineral resources survey team from Japan. The Japanese government is paying 75 percent of the cost of the mission, first of its kind to be sent by Japan to this country. Similar missions have been sponsored by the Overseas Mineral Resources Development Cooperation Association, a private Japanese organization, in Pakistan, Iran, and Peru.

MEXICO—A uranium deposit described as "important" has been located in an old abandoned mercury mine in Cerro de la Cal, Durango. Another uranium deposit, south of Toluca in the state of Mexico, has been studied by the **Direccion de Recursos Naturales** and analyzed as autunite, assaying 0.8 percent uranium oxide.

CHILE—One of the largest pan feeders ever built was completed recently for the primary crusher station at **Cia Salitera de Tarapaca y Antofagasta.** The giant manganese feeder was ordered from **Taylor-Wharton Company** of Easton, Pennsylvania by the Robins Engineers Division of **Hewitt-Robins, Inc.** The crusher station delivers copper ore which the feeder will receive in chunks up to 1¼ tons. Ore is dropped 24 feet from a railroad car. The feeder can deliver 912 tons of ore an hour at the rate of 20 feet per minute.

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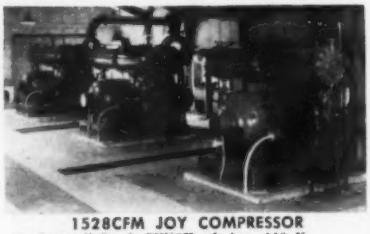

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8' Gayco Air Separator W/Motor
24"x95' Hewitt Robins Belt Conveyor New
2—5'x8' Kennedy Van Saun Air Swept Ball Tube Mills with disc feeders, fans, piping.
4½'x9' KVS Air Swept Ball Mill
2 Wemco 2M—HMS Plants
6'x4' & 6'x9' Traylor Ball Mills
No. 56 and 7'x15' Marcy Ball Mills
10'x48" & 6'x36" Hardinge Ball Mills
4'x11' & 7'x15' Marcy Rod Mills
18"x36" & 15"x24" Rogers RB Jaw Crushers
14"x28", 30x36 & 48"x72 Jaw Crushers
42" Traylor Gyratory Primary Crusher
48"x60" Allis Chalmers 6 Pcs. Frame Jaw Crusher
5½' Symons Std. Cone Crusher
7' Symons Snort Head Cone Crusher
10—No. 6s Wilfley Concentrating Tables
78"x36'6" Akins Duplex Spiral Classifier
5'x30' Ruggles Coles Rotary Dryer
8'x60' Rotary Dryer ½" Welded Shell
3'x30', 9'x162' Allis Chalmers Rotary Kilns
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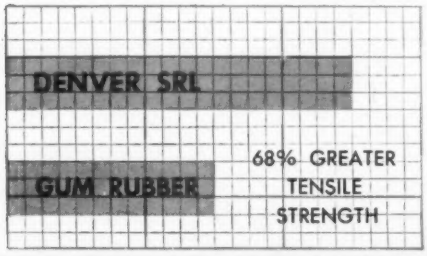


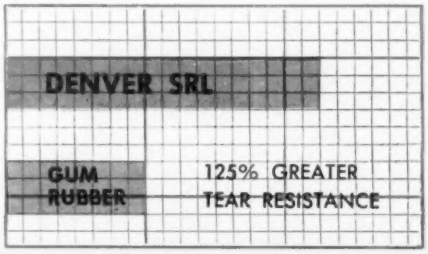


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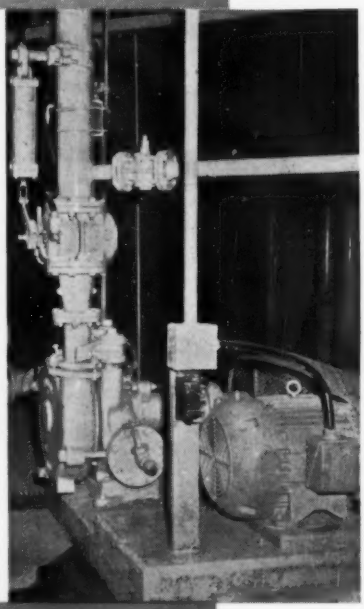

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